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ARTICLES

Fintech and the Innovation Trilemma

CHRIS BRUMMER* & YESHA YADAV**

Whether in response to robo advising, artificial intelligence, or cryptocurrencies such as Bitcoin, regulators around the world have made it a top policy priority to supervise the exponential growth of financial technology (or “fintech”) in the post-crisis era. However, applying traditional regulatory strategies to new technological ecosystems has proved conceptually difficult. Part of the challenge lies in managing the trade-offs that accompany the regulation of innovations that could, conceivably, both help and hurt consumers as well as market participants. Problems also arise from the common assumption that today’s fintech is a mere continuation of the story of innovation that has shaped finance for centuries.

This Article offers a new theoretical framework for understanding and regulating fintech by showing how the supervision of financial innovation is invariably bound by what can be described as a policy trilemma. Specifically, we argue that when seeking to provide clear rules, maintain market integrity, and encourage financial innovation, regulators have long been able to achieve, at best, only two out of these three goals. Moreover, today’s innovations exacerbate the trade-offs historically embodied in the trilemma by breaking down financial services supply chains into discrete parts and disintermediating traditional functions using cutting edge, but untested, technologies, thereby introducing unprecedented uncertainty as to their risks and benefits. This Article seeks to catalogue the strategies taken by regulatory authorities to navigate the trilemma, and posits them as operating across a spectrum of interrelated responses. The Article then

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proposes supplemental administrative tools to support not only market, but also regulatory experimentation and innovation.

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INTRODUCTION

When Bitcoin rocketed in value nearly twentyfold in 2017, regulators around the world faced a barrage of questions concerning the rising tide of technology leveraging distributed ledger operating systems for new and emerging ventures.¹ Among the most pressing was just what to call Bitcoin and other virtual currencies such as Ether and Ripple's XRP that were hitting the financial mainstream and promising to transform how payments were made and value exchanged.² Were these "cryptocurrencies" really "currencies" like the U.S. dollar or British pound? Or were they securities? Commodities, akin to a digital version of gold, perhaps?³ Or a construct necessitating an altogether new legal category?

After bouncing around the inboxes of government agencies across the globe, the query leapt to public prominence on the back of financing techniques called initial coin offerings (ICOs) that were designed to help entrepreneurs and technologists raise money for startup projects.⁴ Unlike traditional initial public offerings (IPOs), in which issuers sold stocks and bonds following the disclosure of a heavy load of legally mandated information, ICOs involved offerings of digital "tokens" or "coins" often denominated in a cryptocurrency. After purchase, these virtual assets would entitle participants to non-financial rights like access to the technology the promoters were promising to create and, in some instances, to acquire a pre-prescribed economic interest in the entrepreneur's project as well.⁵ With these ICOs, novel questions arose as to whether the coins were in fact securities, and whether the disclosures and sales made to participants had to meet the

1. See Gertrude Chavez-Dreyfuss, *Bitcoin Hits Another Record High in March Towards \$20,000*, REUTERS (Dec. 12, 2017, 5:30 AM), <https://www.reuters.com/article/uk-markets-bitcoin/bitcoin-hits-another-record-high-in-march-towards-20000-idUSKBN1E60PE> [<https://perma.cc/JJ8F-WUA5>]; Jay Clayton, Chairman, Sec. & Exch. Comm'n, Statement on Cryptocurrencies and Initial Coin Offerings (Dec. 11, 2017), <https://www.sec.gov/news/public-statement/statement-clayton-2017-12-11> [<https://perma.cc/QAQ5-PZDA>].

2. See, e.g., Steven Johnson, *Beyond the Bitcoin Bubble*, N.Y. TIMES (Jan. 16, 2018), <https://www.nytimes.com/2018/01/16/magazine/beyond-the-bitcoin-bubble.html> [<https://nyti.ms/2FGVArL>] (observing also how the "real promise" of blockchain platforms and virtual currencies may lie "not in displacing our currencies but in replacing much of what we now think of as the internet, while at the same time returning the online world to a more decentralized and egalitarian system").

3. See, e.g., Nathaniel Taplin, *Bitcoin Isn't a Currency, It's a Commodity—Price It that Way*, WALL ST. J. (Jan. 3, 2018, 11:52 PM), <https://www.wsj.com/articles/bitcoin-isnt-a-currency-its-a-commodity-price-it-that-way-1515041387> [<https://perma.cc/4V6W-2QHC>].

4. See generally *Investor Bulletin: Initial Coin Offerings*, U.S. SEC. & EXCH. COMM'N (July 25, 2017), <https://www.investor.gov/additional-resources/news-alerts/alerts-bulletins/investor-bulletin-initial-coin-offerings> [<https://perma.cc/B3DB-8DD5>]; Nathaniel Popper, *Despite S.E.C. Warning, Wave of Initial Coin Offerings Grows*, N.Y. TIMES (Aug. 7, 2017), <https://www.nytimes.com/2017/08/07/business/dealbook/initial-coin-offerings-sec-virtual-currency.html> [<https://nyti.ms/2vddEGR>]; Nathaniel Popper, *S.E.C. Issues Warning on Initial Coin Offerings*, N.Y. TIMES (July 25, 2017), <https://www.nytimes.com/2017/07/25/business/sec-issues-warning-on-initial-coin-offerings.html> [<https://nyti.ms/2tJJSuF>].

5. See *Investor Bulletin*, *supra* note 4; see also Chris Brummer et al., *What Should be Disclosed in an ICO?*, in CRYPTOASSETS (forthcoming 2019), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3293311 [<https://perma.cc/Q26R-9VR7>].

requirements of U.S. securities laws.⁶ The Securities and Exchange Commission (SEC) responded by announcing that the question would ultimately depend on the facts and circumstances of the offering, and warned that many of the digital tokens could comprise investment contracts as defined under the *Howey* test, its long-established yardstick for determining whether a non-conventional financial product is a security.⁷ Although the announcement provided some clarity to the question whether ICO offerings could be regulated, the absence of bright-line rules and the need to apply the multi-part *Howey* test to at times complex technical systems, underscored ongoing uncertainties about the exact application of securities laws to these novel financing techniques.⁸

Yet for all of the attention it generated, the SEC's guidance was not the first public foray by securities regulators into the oversight of new digital technologies, or even the first of that regulatory cycle. When markets tumbled in the wake of the United Kingdom's vote to leave the European Union in June 2016, Betterment LLC—an investment advisory firm then managing \$4.8 billion—temporarily halted trading.⁹ Betterment's decision was one largely in sync with

6. See, e.g., DAVISPOLK, SEC CONFIRMS THAT SOME INITIAL COIN OFFERINGS ARE ILLEGAL UNREGISTERED SECURITIES OFFERINGS (2017), https://www.davispolk.com/files/2017-07-27_sec_confirms_that_some_initial_coin_offerings_are_illegal_unregistered_securities_offerings.pdf (noting that although the “technologies underlying” ICOs “are radically new,” regulators will look to regulate them using existing securities laws).

7. See *Investor Bulletin*, *supra* note 4; see also Exchange Act Release No. 81,207, 117 SEC Docket 34-81,207 (July 25, 2017); *SEC Debuts Roadmap for Resolving Illegal ICOs*, DAVISPOLK (Nov. 20, 2018), <https://alerts.davispolk.com/10/4020/uploads/2018-11-20-sec-debuts-roadmap-resolving-illegal-icos.pdf?sid=dfc0db0d1-5332-4548-adf3-91a9f1f43b94> [<https://perma.cc/8EYV-LCX9>]. The U.S. Supreme Court established the *Howey* test in *SEC v. W.J. Howey Co.*, 328 U.S. 293 (1946), as the standard by which to determine whether a claim might be deemed to be an investment contract and thus a security under Section 2(1) of the Securities Act of 1933. See Securities Act of 1933, ch. 38, § 2(1), 48 Stat. 74, 74 (codified as amended at 15 U.S.C. § 77b(a)(1) (2012)). According to the *Howey* test, unless the context suggests otherwise, a claim is a security if it constitutes (i) an investment of money (ii) as part of a common enterprise (iii) for profits and (iv) these profits are generated through the managerial efforts of parties other than the investors. *Howey*, 328 U.S. at 301. These criteria have long constituted the basis for extensive litigation and caselaw. See also a nuanced and detailed speech by William Hinman, SEC Director of Corporation Finance, analyzing the application of the *Howey* test to digital assets like cryptocurrencies and ICOs and how distributed ledger networks impact this determination. William Hinman, Director, Div. of Corp. Fin., Sec. & Exch. Comm'n, Remarks at the Yahoo Finance All Markets Summit: Crypto: Digital Asset Transactions: When *Howey* Met Gary (Plastic) (June 14, 2018), <https://www.sec.gov/news/speech/speech-hinman-061418> [<https://perma.cc/557S-29VZ>]; see also Chris Brummer et al., *supra* note 5.

8. See Karsten Wöckener et al., *Regulation of Initial Coin Offerings*, WHITE & CASE (Dec. 15, 2017), <https://www.whitecase.com/publications/alert/regulation-initial-coin-offerings> [<https://perma.cc/HY62-HLZJ>]; see also *Examining the Cryptocurrencies and ICO Markets: Hearing Before the H. Comm. on Fin. Servs.*, 115th Cong. 42–48 (statement of Chris Brummer, Professor Georgetown University Law Center, noting the importance of clear and tailored disclosure rules for ICOs).

9. See Michael Wursthorn & Anne Tergesen, *Robo Adviser Betterment Suspended Trading During 'Brexit' Market Turmoil*, WALL ST. J. (June 24, 2016, 7:31 PM), <https://www.wsj.com/articles/robo-adviser-betterment-suspended-trading-during-brexit-market-turmoil-1466811073> [<https://perma.cc/G6NL-KTSM>]; see also Riva Gold, Mike Bird & Akane Otani, *Dow Industrials Tumble After 'Brexit' Vote*, WALL ST. J. (June 25, 2016, 11:18 PM), <https://www.wsj.com/articles/pound-plunges-on-u-k-vote-to-leave-eu-1466753711> [<https://perma.cc/DDM4-R9NZ>] (describing how the “shock from the

investor protection: choosing to spare its clients the higher transaction costs that accompanied bouts of volatility like those following Brexit.¹⁰ What caught regulators' attention, however, was the disputable quality of disclosures Betterment made to its customers about when and how Betterment might restrict their trading opportunities.¹¹ But a possible reprimand by securities regulators would first require a determination as to how Betterment was even regulated. Betterment was not, after all, the usual "bricks-and-mortar" investment firm, long the subject of detailed securities rulemaking.¹² Instead, it was a radically new entity—a "robo advisor" that relied on automated algorithms to manage and allocate client funds into preferred investment opportunities.¹³

Other U.S. regulators have faced similar challenges when regulating novel products and technologies in an increasingly digital marketplace.¹⁴ For all of the SEC's high profile interventions in the ICO market, the Commodity Futures Trading Commission (CFTC), the U.S. regulator of commodities and derivatives securities, is widely considered to be the likely primary regulator of Bitcoin and Bitcoin-related derivatives as well as other major crypto-currencies like

U.K.'s surprise vote to leave the European Union swept across global markets, punishing stocks, the British pound and emerging-market currencies").

10. Betterment's assets under management have been growing rapidly, reaching around \$8.5 billion in April 2017. See Peter Cohan, *Growing at 300% to \$8.5 Billion, Betterment Offers Fee, Tax Edge*, FORBES (Apr. 26, 2017, 8:29 AM), <https://www.forbes.com/sites/petercohan/2017/04/26/growing-at-300-to-8-5-billion-betterment-offers-fee-tax-edge/#10aa592b3ff3> [https://perma.cc/3E87-D5JV].

11. See Suleman Din, *Robo-Advisor's Brexit Trading Freeze Backfires*, AM. BANKER (June 29, 2016, 3:30 PM), <https://www.americanbanker.com/news/robo-advisers-brexite-trading-freeze-backfires> [https://perma.cc/H2G9-5LUT]; Wursthorn & Tergesen, *supra* note 9.

12. This field of regulation is vast. See, e.g., Investment Advisory Act of 1940, 15 U.S.C. § 80b-1 to 80b-20 (2012).

13. See Gregg Schoenberg, *Betterment Keeps Growing As Fintech Competitors Rise*, TECHCRUNCH, <https://techcrunch.com/2018/09/28/betterment-keeps-growing-as-fintech-competitors-rise/> [https://perma.cc/EDZ9-F5DW] (last visited Dec. 10, 2018); Wursthorn & Tergesen, *supra* note 9; see also Michael Wursthorn, *Regulator Tells Betterment to Revise Policies After June Trading Halt*, WALL ST. J. (Sept. 15, 2016, 2:00 PM), <https://www.wsj.com/articles/regulator-tells-betterment-to-revise-policies-after-june-trading-halt-1473962235> [https://perma.cc/Q4MV-8YSX].

On robo advising and the growth of the industry, including discussion of costs and benefits of firms, see generally *Can Robo Advisers Replace Human Financial Advisers?*, WALL ST. J. (Feb. 28, 2016, 10:12 PM), <https://www.wsj.com/articles/can-robo-advisers-replace-human-financial-advisers-1456715553> [https://perma.cc/FQ3D-HMHM], and Tom Baker & Benedict Dellaert, *Regulating Robo Advice Across the Financial Services Industry*, 103 IOWA L. REV. 713 (2018). In addition, Anne Tergesen and Michael Wursthorn, describe concerns by the Massachusetts Secretary of the Commonwealth regarding the trading halt and the broader capacity of robo advisors to act as fiduciaries. Anne Tergesen & Michael Wursthorn, *Robo Adviser Betterment Stokes Concern Over Brexit Trading Halt*, WALL ST. J. (July 2, 2016, 2:37 PM), <https://www.wsj.com/articles/robo-adviser-betterment-stokes-concern-over-brexite-trading-halt-1467403366> [https://perma.cc/H5QM-93CV].

14. For an outline of fintech and its key technologies, see CHRIS BRUMMER & DANIEL GORFINE, MILKEN INST., *FINTECH: BUILDING A 21ST-CENTURY REGULATOR'S TOOLKIT* (2014). For a discussion of the Federal Trade Commission's interest in regulating unfair and deceptive practices for nonbank financial firms, see JUSTINE A. DI GIOVANNI ET AL., DAVISPOLK, *THE FTC'S GROWING ENFORCEMENT INTEREST IN FINTECH* (2018), https://www.finregreform.com/wp-content/uploads/sites/32/2018/09/2018-09-11_The_FTCs_Growing_Enforcement_Interest_in_Fintech.pdf.

Ethereum.¹⁵ Moreover, the CFTC has been tasked with introducing *more*, not less, technological innovation since the passage of the Dodd–Frank Wall Street Reform and Consumer Protection Act (Dodd–Frank Act) in 2010, in order to facilitate greater transparency and integrity in derivatives markets.¹⁶ Meanwhile, banking regulators—including the Office of the Comptroller of the Currency (OCC), Federal Deposit Insurance Commission (FDIC), Federal Reserve, and Bureau of Consumer Financial Protection (CFPB)—have all grappled with how to oversee and regulate new technologically savvy entrants into the lending and payments industries. From seemingly out of nowhere, thousands of new upstart firms operating without a physical presence are clamoring to offer all-digital,

15. In accordance with its mandate, the CFTC can act to prevent fraud and manipulation in commodities that serve as reference assets for derivatives. *See* U.S. COMMODITY FUTURES TRADING COMM’N, A CFTC PRIMER ON VIRTUAL CURRENCIES 10–13 (2017), https://www.cftc.gov/sites/default/files/idc/groups/public/%40customerprotection/documents/file/labcfrc_primercurrencies100417.pdf. In 2015, the CFTC determined that virtual currencies could be “commodities” under the jurisdiction of the CFTC, a determination upheld in federal court. Press Release, U.S. Commodity Futures Trading Comm’n, CFTC Staff Issues Advisory for Virtual Currency Products (May 21, 2018), <https://www.cftc.gov/PressRoom/PressReleases/7731-18> [<https://perma.cc/5ECT-Q8R5>]; *see also* OFFICE OF THE N.Y. ATTORNEY GEN., VIRTUAL MARKETS INTEGRITY INITIATIVE (2018), https://ag.ny.gov/sites/default/files/vmii_report.pdf; Jai R. Massari et al., *CFTC Acts Against Bitcoin Fraud: Enforcement Against Garden Variety Fraud with Implications for Virtual Currencies and ICOs*, DAVISPOLK (Sept. 22, 2017), <https://www.finregreform.com/single-post/2017/09/22/cftc-acts-against-bitcoin-fraud-enforcement-against-garden-variety-fraud-with-implications-for-virtual-currencies-and-icos/> [<https://perma.cc/6XK2-KQEC>]; Brendan Pierson, *Virtual Currencies Are Commodities, U.S. Judge Rules*, REUTERS (Mar. 6, 2018, 6:11 PM), <https://www.reuters.com/article/us-usa-cftc-bitcoin/virtual-currencies-are-commodities-u-s-judge-rules-idUSKCN1GI32C> [<https://perma.cc/6D3X-N7AB>]; Press Release, U.S. Commodity Futures Trading Comm’n, CFTC Charges Nicholas Gelfman and Gelfman Blueprint, Inc. with Fraudulent Solicitation, Misappropriation, and Issuing False Account Statements in Bitcoin Ponzi Scheme (Sept. 21, 2017), <http://www.cftc.gov/PressRoom/PressReleases/pr7614-17> [<https://perma.cc/4SJS-A8VW>].

By contrast, classifying virtual currencies as “securities” under the Securities Act of 1933 represents a thornier task. Take, for example, the distributed ledger technology underpinning virtual currencies like Bitcoin. It disassociates the currency’s value from a group of promoters and vests it in a decentralized operating system without a central locus of responsibility. This, notes SEC Director Hinman, makes it difficult to bring virtual currencies within the definition of a security under the *Howey* test. Hinman, *supra* note 7; *see also supra* note 7. However, depending on a fact-based, case-by-case analysis, it may be that a particular scheme qualifies as a security. *See* Wöckener et al., *supra* note 8. On the introduction of Bitcoin derivatives, *see*, for example, *Factbox: Cboe Launches Bitcoin Futures Contracts, CME to Follow*, REUTERS (Dec. 7, 2017, 1:04 AM), <https://uk.reuters.com/article/us-bitcoin-futures-contracts-factbox/factbox-cboe-cme-to-launch-bitcoin-futures-contracts-idUKKBN1E10J8> [<https://perma.cc/GA28-RLNX>].

16. Title IX of the Dodd–Frank Act—the Investor Protection and Securities Reform Act of 2010—mandated thoroughgoing changes to encourage financial innovation while also regulating it, pushing the introduction of electronic trading and reporting platforms to help markets make better sense of certain derivatives transactions and their relevance for financial stability. *See* Dodd–Frank Wall Street Reform and Consumer Protection Act, Pub. L. No. 111-203, § 901, 124 Stat. 1376, 1822 (2010) (codified at 15 U.S.C. § 78a (2010)). The Chairman and Chief Economist at the CFTC noted the effectiveness of reforms to the derivatives markets since the passage of the Dodd–Frank Act. *See* J. CHRISTOPHER GIANCARLO & BRUCE TUCKMAN, U.S. COMMODITY FUTURES TRADING COMM’N, SWAPS REGULATION VERSION 2.0: AN ASSESSMENT OF THE CURRENT IMPLEMENTATION OF REFORM AND PROPOSALS FOR NEXT STEPS, at iv (2018), https://www.cftc.gov/sites/default/files/2018-04/oce_chairman_swapsregversion2whitepaper_042618.pdf.

mobile-ready credit and payment products, allowing consumers to access seemingly cost-effective financial products at the touch of a button.¹⁷

One of the first questions regulators face when charged with regulating fintech—the use of digital technologies in finance—is just how different its services are from more traditional finance.¹⁸ To the extent that fintech products and offerings map neatly onto historical precedent, regulators can confidently draw on tried-and-tested supervisory strategies and apply them with few if any

17. See *infra* Sections III.A–III.C. For example, the Federal Reserve has engaged in efforts to analyze the place of fintech in the context of banking and payments technology. See, e.g., Lael Brainard, Member, Bd. of Governors of the Fed. Reserve, *Where Do Banks Fit in the Fintech Stack?*, Speech at the Northwestern Kellogg Public-Private Interface Conference on “New Developments in Consumer Finance: Research & Practice” (Apr. 28, 2017), <https://www.federalreserve.gov/newsevents/speech/brainard20170428a.htm> [<https://perma.cc/2BK2-SWND>]; John Schindler, *FinTech and Financial Innovation: Drivers and Depth* (Fin. & Econ. Discussion Series, Preliminary Draft No. 2017-081, 2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3029731 [<https://perma.cc/7XEY-ZW3N>].

The FDIC and OCC are examining, *inter alia*, the growth and impact of nonbank providers of banking-like technologies. See, e.g., Katanga Johnson, *U.S. Regulator to Publish Fintech Charter Position in Next Few Months*, REUTERS (Apr. 9, 2018, 12:01 PM), <https://www.reuters.com/article/usa-occ-otting/u-s-regulator-to-publish-fintech-charter-position-in-next-few-months-idUSKBN1HG2FA> [<https://perma.cc/7KLT-VZBX>]; Michelle Price, *Trump’s Pick to Head FDIC Vows to Address Non-Bank Licenses “Hold-Up,”* REUTERS (Jan. 23, 2018, 1:15 PM), <https://in.reuters.com/article/usa-senate-fdic/update-1-trumps-pick-to-head-fdic-vows-to-address-non-bank-licenses-hold-up-idINL2N1PI17B> [<https://perma.cc/JPK9-CNU4>]; *OCC Grants Preliminary Conditional Approval to Varo Bank, N.A.*, SULLIVAN & CROMWELL LLP (Sept. 5, 2018), <https://www.sullcrom.com/files/upload/SCPublication-OCC-Grants-Preliminary-Conditional-Approval-to-Varo-Bank-NA.pdf>.

The CFPB has also been exploring innovations in the context of consumer lending and data analysis. See, e.g., Genevieve Melford & Dan Quan, *Project Catalyst Collaboration to Improve Understanding of Financial Well-Being*, U.S. CONSUMER FIN. PROT. BUREAU (Sept. 18, 2017), <https://www.consumerfinance.gov/about-us/blog/project-catalyst-collaboration-improve-understanding-financial-well-being/> [<https://perma.cc/D3BF-DWVV>].

18. We work within this broad definition of fintech—that is, the use of digital technologies in finance—referencing the reliance of fintech on computer technology. To distinguish today’s fintech from past iterations of innovation, we suggest in this Article that today’s fintech generally (i) relies on the use of big data; (ii) involves complex algorithms and artificial intelligence; and (iii) showcases a tendency to seek out disintermediation in traditional financial services and supply chains by a nontraditional set of firms. See generally Saule T. Omarova, *New Tech v. New Deal: Fintech as a Systemic Phenomenon*, 36 YALE J. REG. (forthcoming 2019), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3224393 [<https://perma.cc/MEF8-2CSQ>] (arguing that fintech is recalibrating the balance of powers between public regulators and private financial firms); Christophe Williams, *What is Fintech?*, WHARTON FINTECH (Feb. 16, 2016), <http://www.whartonfintech.org/blog-archive/2016/2/16/what-is-fintech> [<https://perma.cc/6VKL-VLKJ>] (defining fintech as “an economic industry composed of companies that use technology to make financial systems more efficient” and explaining that fintech companies “cover a wide range of sub-industries” but share a common attribute in that “they build and implement technology which is used to make financial markets and systems more efficient”).

However, the definition of fintech can vary. See, e.g., Mark Carney, Governor of the Bank of Eng. & Chair of the Fin. Stability Bd., *The Promise of FinTech—Something New Under the Sun?*, Speech at the G20 Conference on “Digitising Finance, Financial Inclusion and Financial Literacy” (Jan. 25, 2017), <https://www.bankofengland.co.uk/speech/2017/the-promise-of-fintech-something-new-under-the-sun> [<https://perma.cc/2MA9-GV72>] (identifying the unbundling of traditional intermediary functions as characteristic of fintech). In addition, for a description of automating compliance and the role of technology in supervision and regulation, see generally Luca Enriques, *Financial Supervisors and RegTech: Four Roles and Four Challenges*, REVUE TRIMESTRIELLE DE DROIT FINANCIER (forthcoming), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3087292 [<https://perma.cc/YGX3-CCR7>].

adaptations. On the other hand, if fintech really is new, supervisors should, at a minimum, reevaluate established regulatory approaches to ensure policies remain effective for the public and markets that depend on them.

Unsurprisingly, for some analysts, fintech represents nothing but a new iteration of the longstanding story of innovation in finance.¹⁹ We disagree and argue that in fact *this time is different*: fintech represents a phenomenon distinct from earlier eras of innovation. For one, much of today's innovation in the design and delivery of financial services utilizes not just more data, but qualitatively different forms of data—spanning social media, websites, or digital metadata—that have never before been available. Second, fintech tends to rely more than ever on not just online services, but also those underpinned by automated and increasingly self-learning operational systems. Finally, and critically, fintech is catalyzed by upstarts that identify and target discrete points in the supply chain for financial services—such as execution of financial transactions, surveillance and monitoring, payment and settlement, or a combination of all or any of these points. Instead of established financial firms offering a one-stop shop for these services, fintech firms are dissecting and disintermediating their delivery, leading to the potential for fragmentation in the supply chain.²⁰

These features, we argue, complicate what is already the inherently difficult regulatory enterprise of overseeing financial innovation. To understand how, this Article argues that the task of regulating financial innovation comprises a policy trilemma. Specifically, when seeking to (i) provide clear rules, (ii) maintain market integrity, and (iii) encourage financial innovation, regulators can achieve, at best, two out of these three objectives. For example, if regulators prioritize market safety and clear rulemaking, they necessarily must do so through broad prohibitions, likely inhibiting financial innovation. Alternatively, if regulators wish to encourage innovation and issue clear rules, they must do so in ways that ultimately result in simple, low-intensity regulatory frameworks, increasing risks to market integrity. Finally, if regulators look to promote innovation and market integrity, they will have to do so through a complex matrix of rules and exemptions, heightening the difficulties of compliance, international coordination and enforcement.

19. See WORLD ECON. FORUM, BEYOND FINTECH: A PRAGMATIC ASSESSMENT OF DISRUPTIVE POTENTIAL IN FINANCIAL SERVICES 12–16 (2017) (noting that although fintech firms have “changed the basis of competition in financial services,” they “have not yet materially changed the competitive landscape”); see also DONG HE ET AL., INT’L MONETARY FUND, FINTECH AND FINANCIAL SERVICES: INITIAL CONSIDERATIONS 5, 9 (2017) (outlining the debate over whether fintech “will be more evolutionary or revolutionary”).

20. See *infra* Sections II.A–C. On the effects of intermediation in financial markets, see, for example, Kathryn Judge, *Intermediary Influence*, 82 U. CHI. L. REV. 573, 592–93 (2015) (discussing how intermediaries can “entrench high-fee regimes” and “promote the affirmative adoption of high-fee institutional arrangements over existing or possible alternatives”). On the role of fintech and systemic risk, see William Magnuson, *Regulating Fintech*, 71 VAND. L. REV. 1167, 1169–72 (2018) (arguing that small fintech players threaten to trigger systemic crisis).

The trilemma's theoretical model allows for a more holistic understanding of how fintech upends and challenges existing regulatory and administrative paradigms. With a proliferation of actors, including unfamiliar upstarts, and varying points at which the supply chain of financial services can be disrupted, the fintech ecosystem looks increasingly complex, muddying the task of rule writing.²¹ Furthermore, just as new technologies present the possibility for welfare gains, such as financial inclusion and competition, the longer-term effects of many innovations still remain unclear. As a result, by dint of poor programming, operational malfunctions, or hacking, they risk undermining core regulatory mandates such as financial stability and the protection of those who depend on financial markets for their economic security.²²

Our theoretical framing also allows for a fuller understanding of diverse administrative reforms seen in the United States and around the world.²³ To meet the supervisory challenges of a digital age and mitigate the trade-offs inherent to the trilemma, regulators are deploying a range of novel administrative tools. Though these various regulatory approaches might, at first glance, appear to diverge from one another, we posit that they can instead be viewed as operating along a spectrum of administrative ambition that includes informal guidance, pilots, licenses, and, most recently, "regulatory sandboxes."²⁴ These mechanisms, at their best, allow for flexible, speedy and tailored interventions. Still, they can be abused, or less ominously, insufficiently adapted to meeting the challenges today's fintech poses. To ensure optimal policy outcomes, supplemental strategies will be needed to navigate the regulatory frontier. Specifically, we argue that regulators will have to adopt more robust pathways for domestic agency cooperation, international standard setting and information-sharing, and private self-regulatory governance if they seek to more fully capture the gains of innovation while preserving the safety and soundness of the financial ecosystem.

The Article proceeds as follows. Part I introduces the trilemma and illustrates its application by surveying key historical periods of financial innovation. Part II analyzes modern fintech and identifies the core features that set it apart from earlier cycles of innovation. Part III examines the spectrum of regulatory responses that policymakers have put forward to oversee fintech. In this Part, we apply the lens of the trilemma to show the trade-offs presented by current regulatory approaches; we examine how these approaches succeed as well as the gaps and risks they create given the novel features of fintech. Part IV offers proposals for regulators designed to help supplement their administrative toolbox as a step toward fostering not just financial but also regulatory experimentation. Finally, the

21. See *infra* Section II.D.

22. See *infra* Part II.

23. There is an important literature on the powers delegated by Congress to administrative agencies. See, e.g., David J. Barron & Todd D. Rakoff, *In Defense of Big Waiver*, 113 COLUM. L. REV. 265 (2013) (detailing the congressional delegation of power to waive statutory requirements passed by Congress to administrative agencies). The literature in this area is vast and a detailed discussion is outside the scope of this Article.

24. See *infra* Part III.

Article concludes with observations about the urgency of harnessing policy innovation to address the complexities of fintech.

I. THE INNOVATION TRILEMMA: THEORY AND EXAMPLES

Whether in the context of Bitcoin or robo advisors, financial regulation is all too often theorized as an expression of a simple binary product of industry interests in innovation and dynamism on the one hand, and consumer protection and market integrity concerns on the other.²⁵ But in practice, oversight is considerably more complicated as regulators seek to achieve welfare objectives that also, among other things, reflect administrative values such as clarity and predictability. In this Part, we explain how, when seeking to simultaneously provide clear rules, maintain market integrity, and encourage financial innovation, regulators confront a trilemma. In looking to achieve market integrity, innovation and rules clarity, regulators are, at best, only able to achieve two out of these three objectives. We illustrate the workings of this trilemma by applying the model to past eras of financial innovation from the 1920s to present day.

A. THE THEORY

Before we begin, first a word on what our theory is *not*. Financial regulators have many mandates. They may include price stability, capital formation, and even antitrust responsibilities. The SEC, for example, is charged with ensuring healthy capital formation, prioritizing investor protection, and “maintain[ing] fair, orderly, and efficient markets.”²⁶ Our theory does not attempt to provide a universal account of these regulatory mandates. Instead, our concept focuses on three foundational objectives which we believe tend to be germane to all regulatory agencies and underlie rulemaking in the context of fintech: (i) market integrity; (ii) rules simplicity; and (iii) financial innovation.

Market integrity is the most intuitive goal. Financial regulators constitute the proverbial “cop[s] on the block.”²⁷ They are tasked with combatting fraud and making sure that consumers of financial services are protected from unfair and illegal acts that could deprive them of money, rights, or both.²⁸ In addition to

25. See, e.g., DAVID LLEWELLYN, *THE ECONOMIC RATIONALE FOR FINANCIAL REGULATION* 5–12 (1999) (discussing theories of regulation and surveying literature on trade-offs).

26. See *What We Do*, U.S. SEC. & EXCHANGE COMMISSION, <https://www.sec.gov/Article/whatwedo.html#laws> [<https://perma.cc/ZSA7-N2AB>] (last visited Oct. 23, 2018). It is important to note that regulators have many objectives, of which we identify and focus on the three that we feel are particularly relevant to fintech.

27. Bjorn Forfang, Opinion, *How Trump’s Financial Cop on the Block Should Prioritize the Job*, THE HILL (June 24, 2017, 9:00 AM), <http://thehill.com/blogs/pundits-blog/finance/339291-how-trumps-financial-cop-on-the-block-should-prioritize-the-job> [<https://perma.cc/9KRD-ZARX>].

28. See, e.g., FIN. INDUS. REGULATORY AUTH. (FINRA), <https://www.finra.org/> [<https://perma.cc/53QK-NVJ4>] (last visited Oct. 23, 2018) (providing tools and advice to help investors protect their investments from fraud); *About SIPC: SIPC Mission*, SEC. INV’R PROT. CORP. (SIPC), <https://www.sipc.org/about-sipc/sipc-mission> [<https://perma.cc/K2J9-XFDT>] (last visited Oct. 23, 2018) (describing SIPC’s mission as “restoring customer cash and securities left in the hands of bankrupt or otherwise financially troubled brokerage firms”); *What We Do*, *supra* note 26 (listing investor protection as one of the SEC’s mandates). See generally Lucian A. Bebchuk & Assaf Hamdani, *Federal Corporate Law:*

ensuring integrity in individual transactions, regulators safeguard financial stability.²⁹ For economies to remain healthy, regulators support the stability of financial firms, the (rational) valuation of markets, and overall market confidence.³⁰ Moreover, they help prevent weaknesses in financial institutions from affecting others and supervise the health of large and systemically interconnected firms.³¹

Market integrity relies on the presence of a number of important regulatory features. First, it requires comprehensive rules that target and address risks to individual actors and the overall market. Robust disclosure regimes are applied where material factors related to investments and financial services are disclosed.³² Strong antifraud protections discourage bad actors from exploiting others, just as safety and soundness measures are applied to prevent undercapitalized and under-resourced firms from endangering the stability of markets.³³ All the while, enforcement provides a credible threat of punishment when rules are ignored.³⁴

Lessons from History, 106 COLUM. L. REV. 1793 (2006) (noting the significance of federal laws in securing well-functioning, safer markets); Donald C. Langevoort, *Managing the "Expectations Gap" in Investor Protection: The SEC and the Post-Enron Reform Agenda*, 48 VILL. L. REV. 1139 (2003) (offering a critical discussion of the SEC's rulemaking following the Enron scandal).

29. See BD. OF GOVERNORS OF THE FED. RESERVE SYS., *THE FEDERAL RESERVE SYSTEM: PURPOSES & FUNCTIONS* 54–71 (10th ed. 2016), https://www.federalreserve.gov/aboutthefed/files/pf_4.pdf (noting that the Federal Reserve was “created in 1913 to promote greater financial stability” and describing how the Federal Reserve “monitors financial system risks and engages at home and abroad to help ensure the system supports a healthy economy”); *CFTC Market Surveillance Program*, U.S. COMMODITY FUTURES TRADING COMM’N, <https://www.cftc.gov/IndustryOversight/MarketSurveillance/CFTCMarketSurveillanceProgram/index.htm> [<https://perma.cc/4NDW-S5LK>] (last visited Oct. 23, 2018) (outlining that the mission of the CFTC market surveillance program “is to identify situations that could pose a threat of manipulation”); *Financial Stability Oversight Council*, U.S. DEP’T OF TREASURY, <https://www.treasury.gov/initiatives/fsoc/Pages/home.aspx> [<https://perma.cc/65YV-ETH5>] (last visited Oct. 23, 2018) (noting that “[t]he Council is charged with identifying risks to the financial stability of the United States; promoting market discipline; and responding to emerging risks to the stability of the United States’ financial system”); *What We Do*, *supra* note 26 (noting that the SEC works to “maintain fair, orderly, and efficient markets” and “promote stability in the markets”).

30. See, e.g., *What We Do*, *supra* note 26.

31. See BD. OF GOVERNORS OF THE FED. RESERVE SYS., *supra* note 29, at 54–71; *Financial Stability Oversight Council*, *supra* note 29. See generally Daniel Schwarcz & David T. Zaring, *Regulation by Threat: Dodd–Frank and the Nonbank Problem*, 84 U. CHL. L. REV. 1813 (2017) (noting the application of stability rules to nonbanks as well as banks).

32. See, e.g., Securities Act of 1933 § 5, 15 U.S.C. § 77e (2012). On continuing disclosure, see sections 13(a), 13(c), 14, and 15(d) of the Securities Exchange Act of 1934. Securities Exchange Act of 1934 §§ 13(a), 13(c), 14, 15(d), 15 U.S.C. §§ 78m(a), 78m(c), 78n, 78o(d) (2012); U.S. SEC. & EXCH. COMM’N, *MARKET 2000: AN EXAMINATION OF CURRENT EQUITY MARKET DEVELOPMENTS* 17 (1994) (“The Division believes that transparency plays a fundamental role in the fairness and efficiency of the secondary markets.”); Lucian Bebchuk et al., *What Matters in Corporate Governance?*, 22 REV. FIN. STUD. 783, 789–96 (2009) (studying the significance of disclosure and corporate governance); Merritt B. Fox et al., *Law, Share Price Accuracy, and Economic Performance: The New Evidence*, 102 MICH. L. REV. 331, 341–44 (2003) (analyzing the benefits of disclosure for market efficiency).

33. See generally Mary Jo White, Chair, U.S. Sec. & Exch. Comm’n, Address at the Econ. Club of N.Y.: The SEC After the Financial Crisis: Protecting Investors, Preserving Markets (Jan. 17, 2017), <https://www.sec.gov/news/speech/the-sec-after-the-financial-crisis.html> [<https://perma.cc/X7Q5-4B8E>] (discussing the significance of SEC regulation in fostering market stability and integrity).

34. Enforcement strategies can vary between regulators and jurisdictions. They may include a “light touch” approach designed to create a more collaborative supervisory culture between regulators and

Market integrity is not the sole objective of financial regulators, however. Embedded in their formal mandates—capital formation, investor protection, competition, and market integrity—is also an interest in developing financial innovation.³⁵ That is, regulators have an interest in advancing products, business practices, and technologies that can assist in raising capital, diversifying investment practices, hedging risks, detecting fraud, and improving the operation of capital markets. For example, technological innovations designed to transmit information more quickly and fully between investors and the market, or between regulators and firms, can facilitate market monitoring. Tools designed to bring power and precision to data collection and analysis can offer a better understanding of the risks building within the market. Innovations giving consumers easier and cheaper access to financial products (for example, on their cellphones) can help promote the goals of financial literacy and inclusion.³⁶

From this standpoint, policymakers seek to create a regulatory environment that cultivates the development of new, interesting, and socially beneficial financial practices. Along with the exercise of risk-sensitive oversight, regulators are tasked with apprising themselves of the potential benefits of financial innovation for market function and consumers.³⁷ Arguably, regulators are arguably required to wield their discretionary administrative and enforcement powers in ways that encourage the development of new technologies and industries that improve the

firms, by which an enforcement action might first commence with dialogue, cautions, and warnings, before the imposition of fines or other punishment. Other jurisdictions can impose greater regulatory intensity, with high fines and punishment for corporate managers. In the United States, for example, securities regulators can also look to private class actions as an important source of discipline. For discussion of the vast literature on these varying regulatory approaches see, for example, Stavros Gadinis & Howell E. Jackson, *Markets as Regulators: A Survey*, 80 S. CAL. L. REV. 1239, 1266–98 (2007) (surveying comparative approaches to the allocation of regulatory responsibilities between agencies and private self-regulation and enforcement intensity between jurisdictions), and Donald C. Langevoort, *The SEC, Retail Investors, and the Institutionalization of the Securities Markets*, 95 VA. L. REV. 1025, 1032–42 (2009) (analyzing divergences between the SEC’s regulatory approach and the U.K.’s “light touch” regulatory model).

35. See, e.g., *LabCFTC Overview*, U.S. COMMODITY FUTURES TRADING COMM’N, <https://www.cftc.gov/LabCFTC/Overview/index.htm> [<https://perma.cc/DGB4-BGHR>] (last visited Oct. 23, 2018) (“LabCFTC is the focal point for the CFTC’s efforts to promote responsible FinTech innovation and fair competition for the benefit of the American public.”); *SEC Fintech Forum*, U.S. SEC. & EXCH. COMM’N, <https://www.sec.gov/spotlight/fintech> [<https://perma.cc/F9TE-RQCK>] (last visited Oct. 23, 2018).

36. See Christopher Woolard, Exec. Dir. of Strategy & Competition, U.K. Fin. Conduct Auth., Speech at Cheung Kong Graduate School of Business: Competition and Innovation in Financial Services: The Regulator’s Perspective (May 11, 2017), <https://www.fca.org.uk/news/speeches/competition-and-innovation-financial-services-regulator-perspective> [<https://perma.cc/45JL-MMZU>] (discussing how regulators promote technological innovations).

37. Regulators have grappled with these challenges across industries. See Elizabeth Pollman & Jordan M. Barry, *Regulatory Entrepreneurship*, 90 S. CAL. L. REV. 383, 386–90 (2017) (highlighting the significance of industry-led changes to regulation); see also Rory Van Loo, *Making Innovation More Competitive: The Case of Fintech*, 65 UCLA L. REV. 232, 248–55, 267–69 (2018) [hereinafter Van Loo, *Making Innovation More Competitive*] (examining the importance of innovation and competition in finance but noting that the current design of federal regulators is not well-suited to fostering financial competition and innovation); Rory Van Loo, *Rise of the Digital Regulator*, 66 DUKE L.J. 1267, 1270–80 (2017) [hereinafter Van Loo, *Rise of the Digital Regulator*] (discussing and critiquing the reliance placed by regulators on algorithms to nudge consumers toward welfare-enhancing choices).

quality, competition, and diversity of the market.³⁸ Innovation can also help achieve other kinds of goals, including market integrity, by better empowering investors, consumers and regulators with tools to more successfully identify risks and malfeasance in the marketplace.³⁹

A final, but often overlooked, objective can be termed “rules simplicity.”⁴⁰ That is, regulators seek to craft rules that are easy to understand, anticipate, and apply.⁴¹ This goal is distinct and not a derivative notion designed to simply operationalize the objectives of market integrity and innovation. Regulatory goals may be advanced through clear and simple rules or through a thicket of more complex, perhaps even obfuscating ones. A focus on rules simplicity as a separate objective underlines the significance of clarity, linguistic precision, reduced bureaucratic load, and rationalized rulemaking as essential parts of the regulatory project, enhancing an understanding of rules and reducing the informational costs attaching to them.⁴² This value has both normative and legal bases. Normatively, rules simplicity reflects that regulatory dictates should attain a level of developed expression such that they provide for certainty, predictability, and stability. Like any set of administrative, judicial, or international rules, regulations should be able to be operationalized in ways that provide order for those bound by them.⁴³ Policymakers can thus create predictability and coherence for financial regulation, clearly articulate the

38. As detailed in Part IV of this Article, regulators might consider a range of ways in which to exercise their rulemaking, supervisory, and enforcement power to encourage innovation. For example, providing formal guidance or no-action letters can offer firms a compliance roadmap to help them determine what kinds of activities are allowed. More recently, regulatory “sandboxes” have offered new firms spaces within which existing rules have been relaxed or selectively disapplied to incentivize experimentation with new financial products. *See infra* Part IV.

39. *See* Van Loo, *Making Innovation More Competitive*, *supra* note 37, at 240–42; *see also* Van Loo, *Rise of the Digital Regulator*, *supra* note 37, at 1279–84 (discussing how digital intermediaries can inform consumers about services and the quality of these services).

40. *See, e.g.*, Press Release, U.S. Commodity Futures Trading Comm’n, CFTC Requests Public Input on Simplifying Rules (May 3, 2017), <https://www.cftc.gov/PressRoom/PressReleases/pr7555-17> [<https://perma.cc/FHN8-F2U2>] (detailing how the CFTC is seeking to implement a policy to “Keep It Simple, Stupid,” or KISS in its rulemaking).

41. Much has been written on the complexities of legal interpretation and the significance of underlying rules to legal interpretation that can offer greater clarity and predictability. *See* William Baude & Stephen E. Sachs, *The Law of Interpretation*, 130 HARV. L. REV. 1079, 1140–47 (2017); *see also* ORGANISATION FOR ECON. CO-OPERATION & DEV., POLICY FRAMEWORK FOR EFFECTIVE AND EFFICIENT FINANCIAL REGULATION 45–55 (2010), <https://www.oecd.org/finance/financial-markets/44362818.pdf> (identifying a checklist of principles for supervision and regulation of financial markets and emphasizing elaboration of regulatory objectives to justify intervention); *Rulemaking Process*, U.S. SEC. & EXCH. COMM’N (July 12, 2002), <https://www.sec.gov/oig/reportspubs/aboutoigaudit347finhtm.html> [<https://perma.cc/V9RD-BLW3>] (providing a clear overview of the SEC’s rulemaking process and the steps necessary to pass a regulation).

There are many challenges to achieving rules simplicity and quantification of regulatory objectives in financial regulation. *See* John C. Coates IV, *Cost-Benefit Analysis of Financial Regulation: Case Studies and Implications*, 124 YALE L.J. 882, 931, 952–954 (2015).

42. *See e.g.*, CASS R. SUNSTEIN, SIMPLER: THE FUTURE OF GOVERNMENT 1–10, 173–89 (2013) (noting efforts to simplify rules at the Office of Information and Regulatory Affairs through the introduction of plain English, summaries of rules, “nudges,” and reduced red tape as a core agency objective).

43. *See Rulemaking Process*, *supra* note 41; *see also* Baude & Sachs, *supra* note 41, at 1140–47 (discussing the challenges of legal interpretation); Cass R. Sunstein, *Interpreting Statutes in the*

consequences of taking certain actions, and explain what the posture of authorities is toward prohibited conduct. Rules simplicity also helps to ensure fairness insofar as the rules applying to any market are easily understood by all seeking to participate in it.⁴⁴

Rules simplicity can help many regulators achieve broad statutory mandates such as increased competition and capital formation in the marketplace.⁴⁵ These larger objectives can benefit from rules simplicity as regulators promulgate laws designed to realize them. Greater simplicity in such regulation can lower the barriers to entry into financial marketplaces, thereby promoting competition and reducing the need for expensive legal and financial advice. It can thus make it easier for smaller firms to compete with larger ones because larger companies have scale advantages in absorbing compliance costs. Rules simplicity can, by extension, help promote capital formation, hedging, and other financial services by lowering costs to consumers and thereby encouraging a larger and more diverse group to enter the market.⁴⁶

B. INTRODUCING THE TRILEMMA

The trilemma arises from our hypothesis that between the three objectives or values highlighted—financial innovation, market integrity, and rules simplicity—regulators can achieve at most two at any given time.

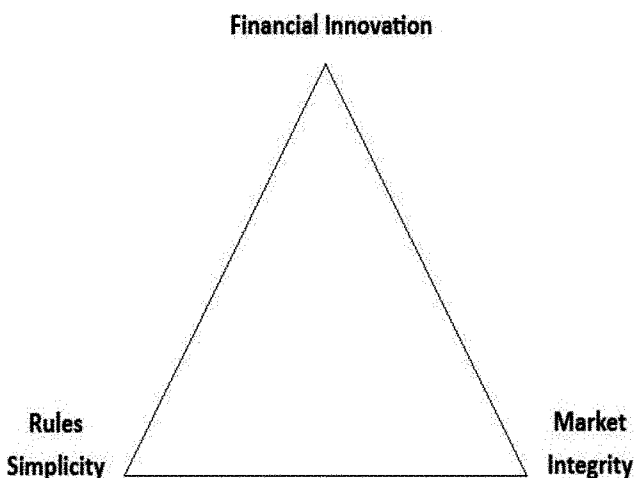


Figure 1: The Trilemma Model

Regulatory State, 103 HARV. L. REV. 405, 420–433 (1989) (highlighting the costs of uncertainty and gaps in rulemaking).

44. See BASEL COMM. ON BANKING SUPERVISION, CORE PRINCIPLES FOR EFFECTIVE BANKING SUPERVISION 14–16 (2012), <https://www.bis.org/publ/bcbs213.pdf> (noting the importance of clarity in regulatory supervision); INT'L ORG. OF SEC. COMM'NS, OBJECTIVES AND PRINCIPLES OF SECURITIES REGULATION 4 (2017), <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD561.pdf> (same); ORGANISATION FOR ECON. CO-OPERATION & DEV., *supra* note 41, at 17–19.

45. See, e.g., Woolard, *supra* note 36; *What We Do*, *supra* note 26.

46. See SUNSTEIN, *supra* note 42, at 7–12.

In short, if regulators prioritize market safety and clear rulemaking, they do so through broad prohibitions, invariably inhibiting financial innovation. Alternatively, if regulators wish to encourage innovation and provide rules clarity, they must do so in ways that ultimately result in simple, low-intensity regulatory frameworks, increasing risks to market integrity and consumers. Finally, if regulators look to enable innovation and promote market integrity, they must do so through a complex matrix of rules and exemptions, raising compliance costs and disproportionately impacting smaller firms and startups.

C. EXAMPLES OF THE TRILEMMA

To understand the trilemma—and our later discussion of how fintech exacerbates some of the trade-offs commonly associated with it—some historical context is useful. In this section, we examine three key episodes in U.S. regulatory history: (i) the New Deal Era as regulators reacted against the financial abuses of the 1920s, the resulting stock market crash, and the Great Depression; (ii) the 1990s and early 2000s as the Gramm–Leach–Bliley Act dismantled key legislation from the New Deal period; and (iii) the years following the 2008 financial crisis and the passage of the Dodd–Frank Act.

These legislative eras represent more than just ordinary cycles in regulation; they also reflect regulatory ambitions to address discrete policy goals (for example, preventing a financial crisis or encouraging innovation) that help approximate the extreme poles represented in the trilemma, illustrating its trade-offs.

1. The Great Depression and the New Deal

Whatever one's view of fintech, virtually all commenters agree that financial innovation *as such* is not new.⁴⁷ The invention of the telegraph in 1832 would launch a more-than-century-long process of mechanical innovation, enabling people to communicate across borders and oceans.⁴⁸ It would also unleash mechanisms by which to track markets and place orders to buy and sell securities at locales far from the exchanges themselves.⁴⁹ The telephone would subsequently find its way to Wall Street in 1878, and revolutionize finance by allowing faster and comparatively more detailed communications between traders.⁵⁰ Fifty years later—and just roughly one year before the great stock market crash of 1929—the New York Stock Exchange (NYSE) would roll out a central quotation system for reporting bid and ask

47. See Eric Biber et al., *Regulating Business Innovation as Policy Disruption: From the Model T to Airbnb*, 70 VAND. L. REV. 1561, 1568–87 (2017) (discussing the significance of history in analyzing innovation).

48. See ROBERT SOBEL, *INSIDE WALL STREET* 30–31, 43 (BeardBooks 2000) (1977).

49. See *id.* at 30–32.

50. See *id.* at 32–33.

prices, and a faster ticker service to publicize them.⁵¹

These developments in the machinery of finance would not be formally described as “financial innovation,” but they did reflect a broader wave of industrialization transforming the United States (and the world). Mid- and late-nineteenth-century inventions such as the railroad, automobile, and airplane began to revolutionize modern life, and companies needed financing to help develop and mass-produce them.⁵² And as World War I came to a close, a generation of Americans, optimistic about the end of hostilities and breathtaking industrial advances, was eager to participate in the country’s booming stock markets—and financiers and bankers were more than willing to oblige (and lure) them with new techniques and strategies for facilitating investment.⁵³

No technique was more important than the experimentation with, and commoditization of, margin trading: instead of people waiting to save up money to invest or businesses plowing profits into ventures, investors began to borrow money from commercial banks to purchase securities.⁵⁴ Meanwhile, to meet the growing demand for investing, commercial banks veered from their traditional expertise of home and real estate lending and loosened their underwriting standards on the assumption that stock markets would never fall.⁵⁵ Some even threw themselves into the surging market by helping companies raise capital in initial public offerings, or even by trading stocks themselves or through affiliates.⁵⁶

For the most part, Wall Street’s imaginative approaches were tolerated by government, even encouraged. A decidedly dim view of regulation, and of financial

51. See Lance E. Davis et al., *The Highest Price Ever: The Great NYSE Seat Sale of 1928–1929 and Capacity Constraints*, 67 J. ECON. HIST. 705, 710 (2007).

52. See DAVID CHAMBERS ET AL., GEOGRAPHY AND CAPITAL: EXPLAINING FOREIGN LISTINGS OF U.S. RAILROAD SECURITIES DURING THE FIRST ERA OF FINANCIAL GLOBALIZATION 4–7 (Draft, Sept. 11, 2012), <http://eh.net/eha/wp-content/uploads/2013/11/Chambersetal.pdf> (discussing the methods through which American railroads were financed in the nineteenth century).

53. See Eugene N. White, *The Stock Market Boom and Crash of 1929 Revisited*, 4 J. ECON. PERSP. 67, 69–71 (1990).

54. See Barry Eichengreen & Kris Mitchener, *The Great Depression as a Credit Boom Gone Wrong* 3, 9–11 (Bank for Int’l Settlements, Working Paper No. 137, 2003), <https://www.bis.org/publ/work137.pdf>. As detailed by Professors Eichengreen & Mitchener, the 1920s boasted a slew of financial and communications innovations following the conclusion of World War I. These included developments in radio technologies, as well as the growth of financial innovations such as the investment trust and collateralized consumer lending. See *id.* at 10. As Eichengreen and Mitchener observe, the advent of the investment trust in the 1920s, in particular, facilitated the growth of margin lending, contributing to the excesses of the age. See *id.* According to this influential line of thought “attribut[ing] the Great Depression to a bubble in the stock market,” Eichengreen and Mitchener state, the ready availability of credit led to speculative excesses, as well as abusive and fraudulent practices, eventually prompting the Federal Reserve to tighten credit conditions. *Id.* at 9–11. These actions contributed to defaults, a sharp decline in asset prices, and eventually a banking crisis. See *id.*

55. See *id.* at 3, 9–11.

56. Randall S. Kroszner & Raghuram G. Rajan, *The Role of Firewalls in Universal Banks: Evidence from Commercial Bank Securities Activities Before the Glass–Steagall Act 4* (Ctr. for the Study of the Econ. & the State, Univ. of Chi., Working Paper No. 103, 1994). Although commercial banks had always to some extent competed with investment banks, their involvement in securities markets increased considerably. See *id.*; see also Eichengreen & Mitchener, *supra* note 54, at 9–11.

supervision more generally, had dominated American politics in the 1920s.⁵⁷ For the intellectual heavyweights of the day, including President Calvin Coolidge, governmental intervention more often than not harmed competition and the growth of financial markets, and thus should be restrained. As Coolidge would argue before the New York Chamber of Commerce:

[T]he largest possible independence between government and business [is most desirable]. Each ought to be sovereign in its own sphere. . . . When government enters the field of business with its great resources, it has a tendency to extravagance and inefficiency, [and], having the power to crush all competitors, likewise closes the door of opportunity and results in monopoly. It is always a problem in a republic to maintain on the one side that efficiency which comes only from trained and skillful management without running into fossilization and autocracy, and to maintain on the other that equality of opportunity which is the result of political and economic liberty without running into dissolution and anarchy.⁵⁸

Though embracing a *laissez-faire* attitude to the changes in financial markets, Coolidge acknowledged a series of trade-offs associated, at least in part, with the trilemma. On the one hand, regulation could, he estimated, avoid “anarchy.”⁵⁹ Coolidge does not define what “anarchy” means, though given the context of his speech and the Wall Street audience, one can safely surmise it might have been understood as financial instability. But it also created less “opportunity.” Government intervention, it was assumed, helped to entrench incumbents (or the government itself) and businesses favored by politicians. Rules could additionally become “fossiliz[ed]” in ways that did not allow for growth and, at least implicitly, innovation.⁶⁰ “Regulation,” the President proclaimed, “ha[d] often become restriction, and inspection ha[d] too frequently been little less than obstruction.”⁶¹ Along this spectrum of choices, Coolidge decided to cast his lot with the market; states, not the federal government, would have to take the lead on overseeing finance.

A reversal of priorities and normative emphasis would arise four years after Coolidge’s departure from power and Herbert Hoover’s unsuccessful term as President.⁶² Presidential candidate Franklin D. Roosevelt would base his

57. See, e.g., McFadden Act, 12 U.S.C. § 36 (2012) (emphasizing, *inter alia*, state regulation and monitoring of the banking sector); *Financial Deregulation in the US*, WHARTON UNIV. OF PA. (Nov. 19, 2018), <https://publicpolicy.wharton.upenn.edu/live/news/2710-financial-deregulation-in-the-us-for-students/blog/news.php> [<https://perma.cc/BJC8-BK6S>].

58. President Calvin Coolidge, Address Before the Chamber of Commerce of the State of New York Regarding Government and Business (Nov. 19, 1925), <https://coolidgefoundation.org/resources/press-as-president-1923-1929-5> [<https://perma.cc/A86T-E5P3>].

59. *Id.*

60. *Id.*

61. *Id.*

62. Herbert Hoover introduced large-scale spending and public works projects to help employ Americans, and his agenda did not include the regulation of finance. Hoover was, however, no friend of regulation. For example, “[e]ven before his inauguration, he urged the Federal Reserve to halt ‘crazy

campaign on an explicitly anti-Wall Street platform, and though not speaking of financial innovation per se, he spoke forcefully about “man’s inventive genius” and its financial permutations. As Roosevelt would proclaim at his 1936 acceptance speech at the Democratic National Convention:

[M]an’s inventive genius released new forces in our land which reordered the lives of our people. The age of machinery, of railroads; of steam and electricity; the telegraph and the radio; mass production, mass distribution—all of these combined to bring forward a new civilization and with it a new problem for those who sought to remain free.

For out of this modern civilization economic royalists carved new dynasties. New kingdoms were built upon concentration of control over material things. Through new uses of corporations, banks and securities, new machinery of industry and agriculture, of labor and capital—all undreamed of by the fathers—the whole structure of modern life was impressed into this royal service.⁶³

For Roosevelt, “new uses of corporations, banks and securities”—key components of what we would today call financial innovation—would serve to entrench a new industrial capital class that was itself built on technological innovation.⁶⁴ This phenomenon, he argued, would have, a negative impact on capitalism and the competition on which it was grounded; “[p]rivate enterprise,” he bemoaned, would become “too private,” a form of “privileged enterprise, not free enterprise.”⁶⁵ In this way, successful innovators would come to dominate markets and exercise control over the prospects of future entrants and competitors. After a point, industrial incumbents would, in short, inhibit future innovation and newcomers.⁶⁶

Even more relevant to the trilemma, Roosevelt viewed the unorthodox practices of Wall Street banks and financiers as having contributed directly to the Great Depression:

and dangerous’ gambling on Wall Street by increasing the discount rate the Federal Reserve charged banks for speculative loans.” Richard Norton Smith & Timothy Walch, *The Ordeal of Herbert Hoover*, 36 PROLOGUE MAG. 30, 33 (2004), <https://www.archives.gov/publications/prologue/2004/summer/hoover-1.html> [<https://perma.cc/KL5H-R3U4>]. He also “asked magazines and newspapers to run stories warning of the dangers of rampant speculation.” *Id.* “Presidents in 1929,” however, “were not supposed to regulate Wall Street, or even talk about the gyrating market for fear of inadvertently setting off a panic, and Hoover backed off.” *Id.* In addition, Hoover “also had a personal reason for keeping quiet”: “His conscience was pained after a friend took his advice to buy a stock that later nose-dived.” *Id.* “‘To clear myself,’ the President told friends, ‘I just bought it back and I have never advised anybody since.’” *Id.*

63. President Franklin D. Roosevelt, Acceptance Speech for the Renomination for the Presidency (June 27, 1936), <https://www.presidency.ucsb.edu/documents/acceptance-speech-for-the-renomination-for-the-presidency-philadelphia-pa> [<https://perma.cc/PYB6-NSLH>] (last visited Oct. 23, 2018).

64. *Id.*

65. *Id.*

66. *Id.*

Enormous corporate surpluses piled up [in the post-WWI period]—the most stupendous in history. Where, under the spell of delirious speculation, did those surpluses go? . . . Why, they went chiefly in two directions: first, into new and unnecessary plants which now stand stark and idle; and second, into the call-money market of Wall Street, either directly by the corporations, or indirectly through the banks. . . .

Then came the crash. You know the story. Surpluses invested in unnecessary plants became idle. Men lost their jobs; purchasing power dried up; banks became frightened and started calling loans. Those who had money were afraid to part with it. Credit contracted. Industry stopped. Commerce declined, and unemployment mounted.⁶⁷

To prevent future threats to market integrity—and to protect jobs and employment—Roosevelt concluded that legislation with teeth was needed.⁶⁸ Roosevelt and his lieutenants would direct their legislative energies toward curbing rampant speculation and restraining the perceived culprits of the financial crisis: banks, stock exchanges, and their salesmen—the broker dealers.⁶⁹ Banks, which had lent money to naïve investors and speculated in securities markets themselves, would have their scope of permitted action curtailed.⁷⁰ Stock markets and commodity markets would be regulated to prevent the dangers posed by excessive speculation.⁷¹

67. President Franklin D. Roosevelt, Address Accepting the Presidential Nomination at the Democratic National Convention (July 2, 1932), <https://www.presidency.ucsb.edu/documents/address-accepting-the-presidential-nomination-the-democratic-national-convention-chicago-1> [<https://perma.cc/U9AZ-F5GR>].

68. See Jerry W. Markham, *Federal Regulation of Margin in the Commodity Futures Industry—History and Theory*, 64 TEMP. L. REV. 59, 69 (1991).

69. Recall that, in the lead up to the 1929 Crash and Great Depression, financial markets were characterized by rampant speculation and excessive credit to unsophisticated investors (through margin lending), as well as risky lending by banks, investment banks, and affiliates. See Eichengreen & Mitchener, *supra* note 54, at 9–11.

70. See Arthur E. Wilmarth, Jr., *Prelude to Glass–Steagall: Abusive Securities Practices by National City Bank and Chase National Bank During the “Roaring Twenties,”* 90 TUL. L. REV. 1285, 1294–1301 (2016).

71. As detailed below, the New Deal Era ushered in tight controls on bank activity through the Glass–Steagall Act, forbidding banks from also engaging in riskier activities like merchant banking. See Saule T. Omarova & Margaret E. Tahyar, *That Which We Call a Bank: Revisiting the History of Bank Holding Company Regulation in the United States*, 31 REV. BANKING & FIN. L. 113, 121–23 (2011). It also saw the creation of comprehensive securities regulation pursuant to the Securities Act of 1933 and the Securities Exchange Act of 1934, and under the oversight of the Securities and Exchange Commission. See generally Steve Thel, *The Original Conception of Section 10(b) of the Securities Exchange Act*, 42 STAN. L. REV. 385 (1990) (discussing the history and purposes of the anti-fraud rules in securities regulation). As a result of these and related reforms, banks were largely prohibited from using their access to customer deposits and credit to engage in risky securities market intermediation (for example, acting as underwriters and broker dealers). See Omarova & Tahyar, *supra*, at 121–23. In turn, securities markets themselves became more reliably informative on account of mandatory disclosure and anti-fraud protection. See Fox et al., *supra* note 32, at 335–36; Thel, *supra* (discussing the enactment and enforcement of Securities Exchange Act section 10(b)).

The overall response embraced in what would come to be known as the New Deal can be primarily summarized along functional lines. Companies wishing to sell securities to the public would be subject to comprehensive disclosure requirements backed by strict antifraud provisions, with elaborate constraints imposed on marketing the offering.⁷² Disclosures would then have to be updated on a quarterly and yearly basis and subject to scrutiny by auditors and other securities professionals.⁷³ Meanwhile, the Glass–Steagall Act, adopted in 1933, prohibited securities underwriting from being performed by firms engaged primarily in the business of banking.⁷⁴ This separation would help prevent any possible abuses by banks (and their affiliates) in trading with cheap debt and taking risks using their own money. In turn, banking would be safer.⁷⁵ As we discuss below, however, ushering in this era of high regulation created costs on the capacity of firms to easily innovate within the financial markets.

2. Fintech 1.0 and Liberalization in the 1980s–2000s

The broad regulatory perimeter established under the New Deal and its implementing legislation would remain for the most part undisturbed for nearly four decades. This outcome was due in large measure to the relative stability of the market ecosystem of the times. Even as the economy grew in size, depth, and importance, innovative advances in finance faced high hurdles.⁷⁶ Financial markets experienced few radical changes and the actors animating them could be regulated with greater consistency.⁷⁷

By the 1980s, the popular adoption of computers would begin to transform finance from the ground up. As computers became cheaper, more widespread, and user-friendly, bankers, analysts, and consumers would no longer have to manually process information, make calculations by hand, or rely on crude

72. See JOEL SELIGMAN, *THE TRANSFORMATION OF WALL STREET: A HISTORY OF THE SECURITIES AND EXCHANGE COMMISSION AND MODERN CORPORATE FINANCE* 73–100 (3d ed. 2003).

73. On continuing disclosure, see Securities Exchange Act of 1934 §§ 13(a), 13(c), 14, 15(d), 15 U.S.C. §§ 78m(a), 78m(c), 78n, 78o(d) (2012).

74. See Banking Act of 1933, Pub. L. No. 73-66, 48 Stat. 162; Omarova & Tahyar, *supra* note 71, at 121–23.

75. See Arthur E. Wilmarth, Jr., *The Road to Repeal of the Glass–Steagall Act*, 17 WAKE FOREST J. BUS. & INTELL. PROP. L. 441, 449–55 (2017) (noting the importance of Glass–Steagall in ensuring safety and soundness).

76. Following the Second World War, the U.S. economy (as measured by Gross Domestic Product (GDP)) grew steadily, as did the size of the banking sector. See BD. OF GOVERNORS OF THE FED. RESERVE SYS., *ALL-BANK STATISTICS UNITED STATES 1896–1955* app. A (1959), https://fraser.stlouisfed.org/files/docs/publications/allbkstat/1896-1955/allbankstats_complete.pdf; GROSS DOMESTIC PRODUCT (GDP), FED. RESERVE BANK OF ST. LOUIS: ECON. RESEARCH, <https://fred.stlouisfed.org/series/GDP> [<https://perma.cc/8F76-4QT2>] (last visited Oct. 24, 2018).

77. Interestingly, even when technology was introduced, its rather limited status impaired trust by regulators. In the 1960s, the volume of transactions for broker-dealers ballooned and back offices were overwhelmed. See SELIGMAN, *supra* note 72, at 457. But efforts to meet the challenge through automation failed, and even doomed leading Wall Street brokerages unprepared and inexperienced in technology. See *id.*

calculators.⁷⁸ Instead, machines could be used to break down, aggregate, and store credit, account, and market data, and information could be inexpensively shared and transmitted electronically, allowing for faster interfaces in communications.⁷⁹ The implications for finance were enormous, sparking innovations in the delivery of financial services from ATM machines to credit cards whose magnetic strips could be read by banks the world over.⁸⁰

As these new tools matured, innovative products and techniques could be created and brought to the financial marketplace. Perhaps none would be as impactful as the entry of “securitization” into mainstream finance.⁸¹ By pooling financial assets such as auto, mortgage and credit card debt and selling bond securities representing claims on the cash flows generated by this auto, mortgage or credit card debt, financial institutions could potentially reduce the risks associated with lending and generate higher profits for themselves.⁸² Using data processing and modeling technologies, firms could use software to extrapolate or simulate pooled cash flows and create varying tranches of risk and allocate different levels of priority to lenders (that is, to bond holders), with those bondholders wishing to hold the least risk being paid out first.⁸³

Similar processing technology giving rise to securitization would also enable the development of complex credit derivatives. No such development would come to engender as much criticism as credit default swaps (CDS). Invented in the mid-1990s, CDSs would at first offer insurance to creditors if a borrower

78. See Iftekhar Hasan et al., *Technology, Automation, and Productivity of Stock Exchanges: International Evidence*, 27 J. BANKING & FIN. 1743 (2003) (empirically surveying the impact of technology-based innovations on stock market performance); Craig Pirrong, *Upstairs, Downstairs: Electronic vs. Open Outcry Exchanges* (Eur. Fin. Ass’n 2003 Ann. Conf., Paper No. 203, 2003) (noting the history of computer technology in securities markets).

79. See Joseph A. Grundfest, *The Future of United States Securities Regulation in an Age of Technological Uncertainty* 15–16 (John M. Olin Program in Law & Econ., Working Paper No. 210, 2000), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=253763 [<https://perma.cc/M3B9-52YD>].

80. See, e.g., David B. Humphrey et al., *Cash, Paper, and Electronic Payments: A Cross-Country Analysis*, 28 J. MONEY, CREDIT & BANKING 914, 914–15 (1996) (discussing how the “social cost of a country’s payment system . . . can be reduced by promoting the shift to electronics”); Stan Sienkiewicz, *The Evolution of EFT Networks from ATMs to New On-Line Debit Payment Products* (Fed. Reserve Bank of Phila., Discussion Paper, 2002) (providing an overview of the evolution of debit cards).

81. Technology may be seen as an operational enabler of securitization that began in the 1960s as a technique pioneered by the government sponsored agencies (Fannie Mae and Freddie Mac) to increase the supply of housing finance. See Neil Fligstein & Adam Goldstein, *The Anatomy of the Mortgage Securitization Crisis* (Inst. for Research on Labor & Emp’t, Working Paper No. 200–10, 2010). Commentators have also pointed to numerous factors that contributed to the growth of the appeal of securitization, such as the collapse of the savings and loans institutions and the abolition of Regulation Q. See *id.*

82. See *id.*

83. See generally ADAM B. ASHCRAFT & TIL SCHUERMANN, FED. RESERVE BANK OF N.Y., UNDERSTANDING THE SECURITIZATION OF SUBPRIME MORTGAGE CREDIT (2008), https://www.newyorkfed.org/medialibrary/media/research/staff_reports/sr318.pdf (overviewing the subprime mortgage securitization process). See also Nicola Cetorelli et al., *The Evolution of Banks and Financial Intermediation: Framing the Analysis*, 18 ECON. POL’Y REV. 1, 3–4 (2012) (discussing securitization-based intermediation).

defaulted on loans.⁸⁴ Over time, however, they would also become more speculative. Instead of using CDSs to insure risks on their books, banks and securities firms began to enter into transactions—often concerning securities in which they had no direct interest—as a means of placing bets on whether defaults, bankruptcies, or other credit events would arise.⁸⁵ Here, too, technology would play an important role: to help facilitate the trading of CDSs, electronic trading systems for over-the-counter (OTC) derivatives were developed to “link buyers and sellers that previously interacted through telephones and faxes.”⁸⁶

Policymakers would support the development of both securitization and OTC derivatives through deregulatory policies. In banking, the path would be a circuitous one. Congress passed the Gramm–Leach–Bliley Act to help commercial banks compete with the rise of securitization by less-regulated firms.⁸⁷ Under this legislation, prohibitions against national banks affiliating with firms in the investment banking business would be dismantled.⁸⁸ Banks would be offered more leeway to compete alongside investment banks in capital markets, and even merge with securities firms to create large financial conglomerates.⁸⁹

Congress would also act a year later to broadly deregulate the derivatives markets.⁹⁰ As discussed below, pursuant to the Commodity Futures Modernization Act (CFMA), OTC derivatives (swaps) agreed to between “sophisticated” parties

84. See Yesha Yadav, *Insider Trading in Derivatives Markets*, 103 GEO. L.J. 381, 387–95 (2015) (describing the CDS market and the implications of CDS trading); Harry Wilson, *A Short History of Credit Default Swaps*, TELEGRAPH (Sep. 6, 2011, 7:44 PM), <http://www.telegraph.co.uk/finance/newsbysector/banksandfinance/8745511/A-short-history-of-credit-default-swaps.html> [<https://perma.cc/WTX6-FFHQ>]. In these transactions, a protection seller would analyze the risk that a borrower posed to a creditor and offer, for a fee, to take over payments to the creditor should an enumerated act of default arise. See Wilson, *supra*.

85. See generally Frank Partnoy & David A. Skeel, Jr., *The Promise and Perils of Credit Derivatives*, 75 U. CIN. L. REV. 1019, 1022 (2007) (noting that CDSs “have grown from a small private market in the early 1990s to a liquid, standardized market today”); Douglas J. Lucas et al., *Collateralized Debt Obligations and Credit Risk Transfer* (Yale Int’l Ctr. for Fin., Working Paper No. 07–06, 2007) (describing the core economic function and transactional basics of CDS).

86. U.S. GEN. ACCOUNTING OFFICE, COMMODITY EXCHANGE ACT: ISSUES RELATED TO THE REGULATION OF ELECTRONIC TRADING SYSTEMS 3 (2000), <http://www.gao.gov/assets/230/229069.pdf>.

87. See Gramm–Leach–Bliley Act, Pub. L. No. 106-102, 113 Stat. 1338 (1999). In part, because of securitization, the traditional lines of demarcation between banks and securities firms eroded as more nonbanks utilized data collection, management, and processing technologies to compete with banks as providers of credit. See generally Saule T. Omarova, *The Merchants of Wall Street: Banking, Commerce, and Commodities*, 98 MINN. L. REV. 265 (2013) (discussing the role of banks in the commodity trading and warehousing business); Saule T. Omarova, *From Gramm–Leach–Bliley to Dodd–Frank: The Unfulfilled Promise of Section 23A of the Federal Reserve Act*, 89 N.C. L. REV. 1683 (2011) [hereinafter Omarova, *From Gramm–Leach–Bliley*] (analyzing the gradual broadening of permitted bank-related activities despite the Glass–Steagall Act); Saule T. Omarova, *The Quiet Metamorphosis: How Derivatives Changed the “Business of Banking,”* 63 U. MIAMI L. REV. 1041 (2009) (highlighting the role of banks in the derivatives industry) [hereinafter Omarova, *The Quiet Metamorphosis*].

88. See David Leonhardt, *Washington’s Invisible Hand*, N.Y. TIMES (Sept. 26, 2008), <https://www.nytimes.com/2008/09/28/magazine/28wwln-reconsider.html> [<https://nyti.ms/2jKkcqB>].

89. Omarova, *From Gramm–Leach–Bliley*, *supra* note 87, at 1706.

90. See Dan Awrey, *The FSA, Integrated Regulation, and the Curious Case of OTC Derivatives*, 13 U. PA. J. BUS. L. 1, 33 (2010).

would not attract regulation as either “futures” or “securities” under the purview of either the CFTC or SEC.⁹¹ One of the more esoteric but important developments concerned the question whether new electronic platforms (called “multilateral transaction execution facilities”) involved in trading swaps should be shielded from oversight.⁹²

Usually, trading infrastructure for derivatives such as platforms would have to be registered with the CFTC. But a Presidential Working Group, comprised of the Chairman of the Federal Reserve, Secretary of the Treasury, and Chairs of the SEC and CFTC, suggested a different approach.⁹³ In a high profile report to the President, these regulators acknowledged the risks of under-regulation, but ultimately decided that subjecting OTC derivatives such as CDSs to a stricter regulatory standard was too onerous.⁹⁴ Not only did the “sophisticated counterparties that use OTC derivatives simply . . . not require the same protections under [federal rules] as those required by retail investors[,]” but “most of the dealers in the swaps market” were, the logic held, already regulated by the SEC as securities firms or by the Federal Reserve (and others) as banks.⁹⁵

Critically, in making their determination, the Working Group placed a heavy emphasis on innovation, and the need to preserve it:⁹⁶

[E]lectronic trading systems for OTC derivatives have only just begun to emerge on a widespread basis, and such systems should be allowed to grow, unburdened by a new anticipatory statutory structure that could prove entirely inappropriate to their eventual evolution.⁹⁷

The GAO would later add:

Continued progress in addressing the regulatory concerns raised by electronic systems could be critical to the ability of the U.S. exchange-traded futures and

91. See Commodity Futures Modernization Act of 2000, Pub. L. No. 106-554, 114 Stat. 2763. It is worth noting that the Act did not entirely dispense with all regulation vis-à-vis OTC derivatives. For example, certain securities linked to swaps could still attract some anti-fraud liability and banks involved in dealing with OTC derivatives would be subject to wider prudential, safety-and-soundness oversight. See Gabriel D. Rosenberg & Jai R. Massari, *Regulation Through Substitution As a Policy Tool: Swap Futurization Under Dodd-Frank*, 2013 COLUM. BUS. L. REV. 667, 680.

92. See A New Regulatory Framework for Multilateral Transaction Execution Facilities, Intermediaries and Clearing Organizations, 65 Fed. Reg. 77,962 (Dec. 13, 2000) (to be codified at 17 C.F.R. pts. 1, 5, 15, 36, 37, 38, 100, 170, 180).

93. See PRESIDENT’S WORKING GRP. ON FIN. MKTS., OVER-THE-COUNTER DERIVATIVES MARKETS AND THE COMMODITY EXCHANGE ACT 11, 15–17 (1999), <https://www.treasury.gov/resource-center/fin-mkts/Documents/otcact.pdf>.

94. See *id.* at 15–18.

95. *Id.* at 16.

96. When describing the goals of reform, the promotion of financial innovation was articulated first, ahead of all other objectives. See *id.* at 1 (“This Working Group report focuses on changes to the Commodity Exchange Act (the ‘CEA’) that are necessary to promote innovation, competition, efficiency, and transparency in OTC derivatives markets, to reduce systemic risk, and to allow the United States to maintain leadership in these rapidly developing markets.”).

97. *Id.* at 18.

OTC derivatives markets to remain innovative and globally competitive. Such progress requires that the federal financial market regulators remain aware of how rapidly changing technology is affecting the derivatives markets. In particular, regulators need to know whether existing regulations are impeding the development of electronic trading systems in the United States, and whether additional regulations or different regulatory approaches are needed to protect the U.S. markets and their users.⁹⁸

Thus, with the explicit objective of introducing changes designed to “promote innovation, competition, efficiency, liquidity, and transparency in OTC derivatives markets by providing legal certainty for OTC derivatives and removing impediments to innovation,” the Clinton administration would introduce legislation that removed most derivatives entirely from the reach of the CFTC’s oversight.⁹⁹ Under the bipartisan CFMA, most OTC derivatives would escape regulation under applicable securities laws.¹⁰⁰ Additionally, trading on the electronic platforms would, for the most part, escape regulation as full-blown exchanges, avoiding commensurate regulatory burdens for those who used them.¹⁰¹ In this way, regulators concluded, “legal certainty” could be introduced in a manner that “take[s] into account the rapid pace of change in the financial markets and in technology.”¹⁰²

3. The 2008 Financial Crisis and Beyond

Ultimately, history would prove the deregulatory zeal embodied in these particular reforms to be disastrous for the global economy. Large financial conglomerates became increasingly active in the unregulated swaps market, where credit protection had been sold for complex, mortgage-related financial products. When the real estate market collapsed in 2007 and 2008, obligations on the CDS spiked, and once-vaunted Wall Street names from Lehman Brothers to American International Group (AIG) found themselves exposed to firm-ending losses.¹⁰³ Because of the complexity of securitizations and swap contracts and the failure of

98. U.S. GEN. ACCOUNTING OFFICE, COMMODITY EXCHANGE ACT: ISSUES RELATED TO THE REGULATION OF ELECTRONIC TRADING SYSTEMS 4 (2000), <http://www.gao.gov/assets/230/229069.pdf>.

99. Letter from the President’s Working Grp. on Fin. Mkts. to Al Gore, President of the U.S. Senate (Nov. 9, 1999), in PRESIDENT’S WORKING GRP. ON FIN. MKTS., *supra* note 93; Letter from the President’s Working Grp. on Fin. Mkts. to J. Dennis Hastert, Speaker of the U.S. House of Representatives (Nov. 9, 1999), in PRESIDENT’S WORKING GRP. ON FIN. MKTS., *supra* note 93.

100. *See supra* notes 90–92.

101. Notably, exchange traded derivatives were provided with relief as well. *The Commodity Futures Modernization Act of 2000: J. Hearing on S. 2697 Before the S. Comm. on Agric., Nutrition, & Forestry and the H. Comm. on Banking, Hous., & Urban Affairs*, 106th Cong. 10 (2000), <https://www.gpo.gov/fdsys/pkg/CHRG-106shrg70514/pdf/CHRG-106shrg70514.pdf> (noting that the President’s Working Group supported CFTC efforts to provide appropriate regulatory relief for the exchange-traded futures market because some exchange traded futures would have characteristics similar to the excluded OTC derivatives).

102. *Id.* at 6.

103. *See* Ronald J. Gilson & Reinier Kraakman, *Market Efficiency After the Financial Crisis: It’s Still a Matter of Information Costs*, 100 VA. L. REV. 313, 353 (2014); Mark J. Roe, *The Derivatives Market’s Payment Priorities as Financial Crisis Accelerator*, 63 STAN. L. REV. 539, 549–54 (2011);

participants to keep records of their transactions, the exposure of individual firms was unknown even among regulators. As is now well-known, credit markets froze as regulators scrambled to establish which firms were exposed to toxic assets, undermining the health of even robust firms who could no longer find funding.¹⁰⁴ As the crisis deepened, government intervention did too, culminating in the taxpayer-funded bailout of many institutions that had grown too-big-to-fail with the repeal of Glass–Steagall.¹⁰⁵ The debacle would cost the U.S. economy around twenty trillion dollars and a year’s worth of GDP.¹⁰⁶

The congressional response to the 2008 financial crisis—all 848 pages of it—would be comprehensive, with the primary (and, according to some, sole) goal of never again putting taxpayers in the position of bailing out private institutions.¹⁰⁷ Among the many reforms introduced, a new rule, named after former Federal Reserve Chairman Paul Volcker, was outlined that would limit and, in some instances, prohibit bank holding companies from trading on their own money and owning or investing in a hedge fund or private equity fund.¹⁰⁸ This rule would, by design, reintroduce the philosophical posture embraced in Glass–Steagall that commercial banks should not be engaged in highly speculative activities. Banks would also be subject to higher capital charges and prudential measures aimed at minimizing the consequences of the failure of large financial institutions.¹⁰⁹

Richard Squire, *Shareholder Opportunism in a World of Risky Debt*, 123 HARV. L. REV. 1151, 1183 (2010).

104. See generally Gilson & Kraakman, *supra* note 103 (noting the challenge of getting fundamental information during the Crisis); William D. Cohan, *How Goldman Killed A.I.G.*, N.Y. TIMES (Feb. 16, 2011, 9:00 PM), https://opinionator.blogs.nytimes.com/2011/02/16/how-goldman-killed-a-i-g-and-other-stories/?_r=0 [<https://perma.cc/VZ3N-33J7>].

105. Initially, commercial banks were the primary participants in brokering CDS counterparties, though their roles were quickly eclipsed by investment banks when contracts were written for corporate bonds, municipal bonds, and later, structured investment vehicles. See Richard R. Zabel, *Credit Default Swaps: From Protection to Speculation*, ROBINS KAPLAN LLP (Sept. 1, 2008), <http://www.robinskaplan.com/resources/articles/credit-default-swaps-from-protection-to-speculation> [<https://perma.cc/GW3T-7LQS>].

106. U.S. GOV’T ACCOUNTABILITY OFFICE, FINANCIAL REGULATORY REFORM: FINANCIAL CRISIS LOSSES AND POTENTIAL IMPACTS OF THE DODD–FRANK ACT 1 (2013), <https://www.gao.gov/assets/660/651322.pdf>; see also Eleazar David Melendez, *Financial Crisis Cost Tops \$22 Trillion, GAO Says*, HUFFINGTON POST (Feb. 14, 2013, 7:49 PM), https://www.huffingtonpost.com/2013/02/14/financial-crisis-cost-gao_n_2687553.html [<https://perma.cc/8Z8S-LC5M>] (stating that the total cost included the toll on economic output of thirteen trillion dollars, wealth lost by homeowners of more than nine trillion dollars, and losses associated with increased mortgage foreclosures and higher unemployment).

107. See Dodd–Frank Act, Pub. L. No. 111-203, § 951, 124 Stat. 1376, 1899 (2010) (codified at 15 U.S.C. § 78n-1 (2012)); see also *The Dodd–Frank Act: Too Big Not to Fail*, THE ECONOMIST (Feb. 18, 2012), <http://www.economist.com/node/21547784> [<https://perma.cc/5FRN-5PMX>].

108. See Dodd–Frank Act § 619, 12 U.S.C. § 1851 (2012). See generally *Volcker Rule*, BD. OF GOVERNORS OF THE FED. RESERVE SYS., <https://www.federalreserve.gov/supervisionreg/volcker-rule.htm> [<https://perma.cc/8PC8-NUPD>] (last visited Oct. 24, 2018) (providing documents related to the Volker rule).

109. See *Implementing the Dodd–Frank Act: The Federal Reserve Board’s Role*, BD. OF GOVERNORS OF THE FED. RESERVE SYS., <https://www.federalreserve.gov/regreform/reform-actiondates.htm> [<https://perma.cc/SK8T-HPEA>] (last visited Oct. 24, 2018) (highlighting the various regulatory policies designed to enhance the prudential safety of banks).

Meanwhile, the swaps markets would face a new regulatory regime, modeled after the New Deal approach for futures contracts and designed to reign in OTC derivatives. Most dealers (that is, intermediaries) in swaps would face new capital rules. More derivative contracts would have to be standardized, with fewer bespoke, bilateral deals between counterparties and greater reliance on a common-set of terms to facilitate trading between parties.¹¹⁰ Importantly, these standardized contracts would be put on regulated exchanges and subject to strict risk management procedures.¹¹¹ Transactions that continued to be executed off-exchange would face penalties, and transactions would have to be reported as part of prescriptive transacting recording requirements.¹¹² To implement the reforms, nearly 22,000 pages of regulatory content would subsequently be written.¹¹³

From both a legal and technical standpoint, Dodd–Frank’s rules exhibited unprecedented complexity.¹¹⁴ Some of this complexity was due to the fact that multiple regulators worked on the same or similar issues, creating distinct and at

110. Dodd–Frank Act § 731, 7 U.S.C. 6s (2012); § 764, 15 U.S.C. 78o-8 (2012).

111. Dodd–Frank Act § 723, 7 U.S.C. 2 (2012); § 763, 15 U.S.C. 78c-3 (2012).

112. Dodd–Frank Act § 727, 7 U.S.C. 2(a)(13)(G) (2012); § 731, 7 U.S.C. 6s (2012); § 764, 15 U.S.C. 78o-8 (2012).

113. See Arthur W.S. Duff & David Zaring, *New Paradigms and Familiar Tools in the New Derivatives Regulation*, 81 GEO. WASH. L. REV. 677 (2013) (providing an overview of the rules on derivatives mandated by Dodd–Frank); *Data Recordkeeping*, U.S. COMMODITY FUTURES TRADING COMM’N, http://www.cftc.gov/LawRegulation/DoddFrankAct/Rulemakings/DF_17_Recordkeeping/index.htm [<https://perma.cc/8YJA-KFHU>] (listing related rules implemented by the CFTC); Alan Pyke, *5 Numbers to Know as Dodd–Frank Wall Street Reform Celebrates Its 5th Birthday*, THINKPROGRESS (July 21, 2015, 12:00 PM), <https://thinkprogress.org/5-numbers-to-know-as-dodd-frank-wall-street-reform-celebrates-its-5th-birthday-e145f4360b7c> [<https://perma.cc/V7KV-PX7K>] (noting that 22,000 pages of regulatory content have been produced).

114. For example, the Volcker Rule was implemented by four federal agencies that put forward a 298-page proposal that included “383 explicit questions,” which broke “down into 1,420 sub questions.” Stephen Simonis Senior, *A Complex Overreaction. . . . Can You Say Dodd–Frank?*, FIN. MAGNATES (June 12, 2015, 16:06 GMT), <http://www.financemagnates.com/institutional-forex/bloggers/a-complex-overreaction-can-you-say-dodd-frank/> [<https://perma.cc/74LA-E5EU>]. The CFTC “then issued its own proposal on prop[rietary] trading and it was no less that [sic] 489 pages long.” *Id.*

Complexities and possible contradictions are also evident in the differing aims and policies of post-crisis rules. For example, as noted here, a key focus of post-crisis regulation has been to improve the safety and soundness of banks to ensure that they are less susceptible to failure and systemic crisis. In addition, under the Dodd–Frank Act, there has also been a concerted effort to improve the welfare of consumers and investors, notably through the creation of the CFPB. See Consumer Financial Protection Act of 2010, Pub. L. No. 111-203, 124 Stat. 1955 (codified in scattered sections of 12 U.S.C.); see also *Consumer Financial Protection Bureau Fines Wells Fargo \$100 Million for Widespread Illegal Practice of Secretly Opening Unauthorized Accounts*, U.S. CONSUMER FIN. PROT. BUREAU (Sept. 8, 2016), <https://www.consumerfinance.gov/about-us/newsroom/consumer-financial-protection-bureau-fines-wells-fargo-100-million-widespread-illegal-practice-secretly-opening-unauthorized-accounts/> [<https://perma.cc/6W9F-ZBRK>]. There can sometimes be considerable tension between consumer protection and prudential banking regulation. To ensure consumer safety, banks have to invest in compliance and are restricted in undertaking certain (potentially profitable) activities against consumers. With lower profits and reduced cash flow, bank safety and soundness may be at risk. See LLEWELLYN, *supra* note 25, at 7–11.

times contradictory expectations.¹¹⁵ In other instances, complexity deepened as obligatory notice-and-comment processes introduced nuance into otherwise straightforward rules by informing rulemakers of stakeholder complaints and nudging them to incorporate detailed formulas, alternative regulatory regimes, and scales of regulatory intensity to accommodate voiced concerns.¹¹⁶

Nevertheless, the sprawling amalgam of rules, critics argued, would harm the financial system by making it less productive without any corresponding gain in efficacy or safety.¹¹⁷ Meanwhile, regulatory complexity—and the uncertainties caused by unsettled rules, carve-outs, and varied regulatory approaches between countries—would give rise to more organizational complexity as firms adapted to this new terrain.¹¹⁸ Commentators suggested that these regulatory pressures would prove overly expensive for banks as they sunk resources into compliance rather than lending, triggering financial fragilities as firms became too complex and costly to succeed.¹¹⁹

Still, these complaints, often voiced by global banks, attracted little sympathy from policymakers or the wider public.¹²⁰ In some respects, the rules had already accommodated industry's deepest concerns. Regulators had taken a scalpel rather than a hammer to the existing regulatory system, pruning instead of dismantling and breaking up the largest banks.¹²¹ Moreover, the Dodd–Frank reforms reflected a profound skepticism about the value of financial innovation in the

115. See, e.g., DAVISPOLK, COMPARISON OF U.S. PERSON DEFINITIONS, <https://www.davispolk.com/files/uploads/USpersondefinition.pdf> (providing a comparison of SEC and CFTC definitions of person in various rules and guidance).

116. See Kimberly D. Krawiec, *Don't "Screw Joe the Plummer": The Sausage-Making of Financial Reform*, 55 ARIZ. L. REV. 53, 70 (2013).

117. See, e.g., Joe Nocera, *Keep It Simple*, N.Y. TIMES (Jan. 16, 2012), <https://www.nytimes.com/2012/01/17/opinion/bankings-got-a-new-critic.html?smid=pl-share> [<https://nyti.ms/2NG9tOK>].

118. See John Kay, *Complexity, Not Size, Is the Real Danger in Banking*, FIN. TIMES (Apr. 12, 2016), <https://www.ft.com/content/5c2a416e-000f-11e6-99cb-83242733f755?mhq5j=e2> [<https://perma.cc/J4TB-R6P5>] (noting that “[a]s the size of the Dodd-Frank legislation shows, we have locked ourselves into a spiral in which regulatory complexity gives rise to further organisational complexity and the construction of yet more esoteric instruments” and therefore, “[e]ven if legislators had better motives than the present corrupting structure that US campaign finance seems to allow, they cannot hope to have more than a basic knowledge of the rules they promulgate or the workings of the regulatory institutions they have created”).

119. See Brian Peccarelli, *Too Big to Fail? Try Too Complex to Manage*, WORLD ECON. FORUM (Jan. 18, 2017), <https://www.weforum.org/agenda/2017/01/too-big-to-fail-try-too-complex-to-manage/> [<https://perma.cc/9PF7-75M2>] (“The phenomenon has made compliance one of the fastest-growing career categories and elevated the practice of navigating a constantly evolving, ever-expanding web of regulatory requirements to an art form.”).

120. See David Henry & Dan Burns, *JPMorgan CEO Calls for Regulatory Changes in Shareholder Letter*, REUTERS (Apr. 4, 2017, 12:38 PM), <https://www.reuters.com/article/us-jpmorgan-dimon-letter/jpmorgan-ceo-calls-for-regulatory-changes-in-shareholder-letter-idUSKBN17626T> [<https://perma.cc/JFH5-NSJ8>]; Ben McLannahan, *JPMorgan Finance Chief Calls for Easing of Bank Regulation*, FIN. TIMES (Feb. 28, 2017), <https://www.ft.com/content/441be482-fdcb-11e6-8d8e-a5e3738f9ae4> [<https://perma.cc/XUP6-T44L>].

121. See Nathaniel Popper, *JPMorgan Chase Insists It's Worth More as One Than in Pieces*, N.Y. TIMES (Feb. 24, 2015), <https://www.nytimes.com/2015/02/25/business/dealbook/jpmorgan-pushes-back-against-suggestion-of-split.html> [<https://nyti.ms/1EMM2Ev>].

mind of the public, and accorded an elevated importance to market integrity. In the wake of the most perilous financial crisis since the Great Depression, financial stability was paramount. Taxpayers were to be protected at all costs. Paul Volcker lamented that no innovation had been more useful than the simple automatic teller.¹²² Legislators were even more direct. Senator Elizabeth Warren launched a campaign espousing the belief that “banking should be boring.”¹²³ Complex rules, at least implicitly, were a means to achieving this goal.

D. THEORETICAL INTERPRETATION

Each of the major eras of financial oversight serves as a relatively straightforward illustration of the challenges the trilemma poses for regulators of dynamic markets.¹²⁴ The Roaring 1920s represented a period dominated by an embrace of the free market and, by implication, financial innovation. Regulators also opted explicitly for rules simplicity. Few rules existed to constrain the conduct of financial firms. The impact of these twin policy objectives was, of course, financial market instability. Investor confidence plummeted and hailed the coming of the Great Depression.

The New Deal would represent a dramatic change in emphasis. Though reforms would be cast as efforts to save capitalism from capitalists, the New Deal’s Progressive-Era policies would be very much against Wall Street and the free-wheeling 1920s that encouraged excessive speculation. Market integrity would become a priority. To achieve it, a deeply layered set of rules would be developed—with increasing complexity. And even when rules were relatively straightforward, as in the case of the Glass–Steagall Act, they took the form of broad prohibitions against imaginative transactions by bank holding companies.

The New Deal consensus, however, began to erode as regulators and market players responded to emerging technologies in the 1980s and 1990s by incrementally relaxing rules or showing tolerance for pushing their boundaries. Eventually, the deregulatory agenda of the 1990s, embodied by the Gramm–Leach–Bliley Act and the CFMA, featured for the first time an explicit reference to financial innovation, and embraced it along with rules simplicity and market integrity as important objectives.¹²⁵ Yet, despite the professed commitment to

122. See James Shepherd-Barron, *Meet the True Star of Financial Innovation—the Humble ATM*, FIN. TIMES (June 22, 2017), <https://www.ft.com/content/052f9310-5738-11e7-80b6-9bfa4c1f83d2> [<https://perma.cc/FX3R-WG7C>] (noting that Volcker commented “the ATM has been the only useful innovation in banking for the past 20 years”).

123. David Benoit, *Elizabeth Warren: ‘Banking Should Be Boring.’* WALL ST. J. (July 11, 2013, 3:27 PM), <https://blogs.wsj.com/moneybeat/2013/07/11/elizabeth-warren-banking-should-be-boring/> [<https://perma.cc/W3X7-WVDQ>]; see also Elizabeth Warren (@elizabethforma), TWITTER (July 11, 2013, 11:09 AM), <https://twitter.com/elizabethforma/status/355388282261090304> [<https://perma.cc/9R2D-FRDD>].

124. See *supra* Section I.B.

125. See, e.g., Walt Lukken, *Reauthorization: Let the Debate Begin*, 24 FUTURES & DERIVATIVES L. REP. 1, 3–4 (2004) (noting the explosion in innovative derivatives products being authorized for use in the market following passage of the CFMA). On the Gramm–Leach–Bliley Act, rules simplicity, and financial innovation, see generally Anthony M. Santomero, *The Causes and Effects of Financial*

securing rules simplicity and market integrity as well as financial innovation, regulators could not achieve all three goals, and market integrity was ultimately sacrificed. Policymakers consciously withdrew the regulatory perimeter for banking and derivatives, not fully knowing or understanding the full risks and consequences of their decision.

Finally, the Dodd–Frank Act would represent a reassertion of market integrity as an overriding policy priority. New rules would be introduced across financial markets. One of the defining features would be complexity, and one of the stated goals by its most vocal advocates would be the opposite of innovation—the embrace of “boring”—in banking.¹²⁶

Figure two situates these legislative policy priorities and key pieces of implementing regulation within the poles of the trilemma.

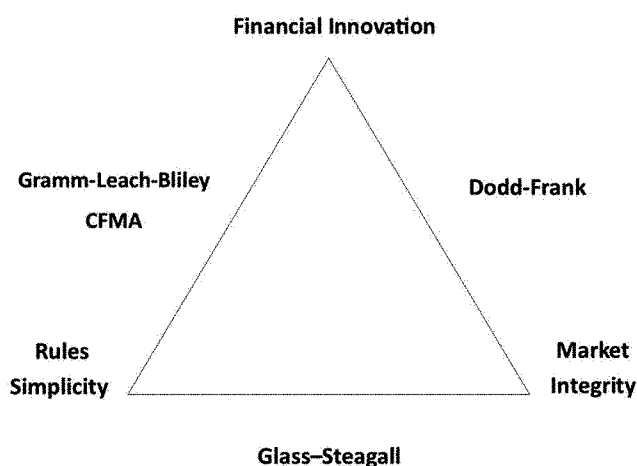


Figure 2: The Trilemma Model and Legislative Policy Priorities

This history provides important lessons for understanding policy formulation. At defining moments of history and often in the name of economic growth, policymakers have dramatically eased financial rules and regulations to spur innovation. However, new financing techniques and technologies—often entirely deregulated and left unchecked—invariably created or enabled dangerous forms of financial risk. When such risks have materialized and cascaded through entire financial systems, policymakers have had to respond to inspire confidence in their financial markets and prevent new crises from arising.

Of course, one might explain such shifts in the regulatory pendulum as just that: shifts that above all reflect immediate political preferences.¹²⁷ From this

Modernization, Q4 2001 BUS. REV. FED. RES. BANK PHILA. 1, 2–4, <https://philadelphiafed.org/-/media/research-and-data/publications/business-review/2001/q4/brq401as.pdf>.

126. See Benoit, *supra* note 123.

127. See, e.g., ERIK F. GERDING, LAW, BUBBLES, AND FINANCIAL REGULATION (2013).

standpoint, financial regulation, like the economy, is cyclical and both financial regulation and the economy stand in counterpoise to another. When economies heat up, rules tend to take a back seat. When crisis then occurs, more intrusive (and onerous) rules emerge as a response as voters demand punishment for some the bad acts or negligence that enabled the crisis.

The history of financial regulation, however, allows for more nuance. Shifts in policy can be viewed not only as responses to exogenous changes in national economics, but also as responses to previous policies captured by the trilemma and the trade-offs generated by them. In short, when financial innovation runs amok, a higher emphasis on market integrity arises. To the extent that there is rules simplicity, it comes in the form of rote prohibitions that in turn, as our model predicts, stifle innovation. Alternatively, when policy choices seek to promote both market integrity and innovation, rules are invariably more complex as more nuance is built into governing administrative regimes.

II. WHAT IS (AND ISN'T) NEW ABOUT FINTECH

So far our discussion of the trilemma has looked backwards. But what do its workings mean for the present and future of financial innovation? Commentators routinely state that modern-day fintech is not particularly new, but rather a continuation of the story of financial and technological innovation captured in part by the preceding analysis.¹²⁸ In this Part, we dispute such conclusions and argue that today's fintech is in fact different. Far from being more of the same, present-day fintech possesses its own set of distinctive features that exacerbate the historic trade-offs inhabiting the trilemma and necessitate a fresh approach to oversight.

We focus on three key features of modern fintech that differentiate it from earlier eras of financial markets and technological innovation: (i) a dependence on vast quantities of conventional as well as novel types of data in the design of fintech products; (ii) the automation of algorithmic programs that often showcase advances in artificial intelligence (AI) and machine learning; and (iii) the emergence of nontraditional, specialist firms whose business models seek to disintermediate financial transactions and take on the dominance of brand-name "one-stop shop" Wall Street firms. These three features together define modern fintech and, as we will see, exacerbate the trade-offs inherent in the trilemma.

The goal of this Part is to connect past innovation with present-day fintech as a basis for analyzing the effectiveness of responses to regulate it. In identifying the use of big data, automation/AI, and the pervasiveness of nontraditional firms as key actors, we highlight brand new risks facing regulators that manifest in deep information asymmetries, an uncertain impact on market integrity, and—as a result—real difficulties in seeking to regulate through clear and simple rules.

128. See *supra* note 19 and accompanying text.

A. BIG (AND NEW KINDS OF) DATA

Financial innovation has always involved advances in information gathering and processing, a point highlighted in Part I's overview of the explosion of securitization and OTC derivatives.¹²⁹ Securitization requires gathering and compiling swaths of borrower data to create pools of loans that generate cash flows for bond investors. Similarly, CDSs rely on tools to aggregate and model data about the credit risk of referenced loans.¹³⁰ Today's fintech, not surprisingly, also relies on information—but exponentially more so.¹³¹ Moreover, the kind of information on which it relies is qualitatively more heterogeneous and diverse.¹³²

A key driver behind the recent explosion of data is the advent of the Internet and the concomitant growth of computing power.¹³³ Not only is more information stored online but the pace of data creation and its rapid availability to those seeking it has accelerated exponentially.¹³⁴ Importantly, unlike in earlier decades, when information on underlying loans or mortgage-backed securities was sourced through central nodes of information—such as credit rating agencies or conventional news organizations—today the production of digital data is often decentralized. Specifically, data emerges from a diffuse proliferation of websites, social media, and various genres of news sources and databases.¹³⁵ It is also the

129. See, e.g., EXEC. OFFICE OF THE PRESIDENT, *BIG DATA: SEIZING OPPORTUNITIES, PRESERVING VALUES* 1–2 (2014). See generally Salon Barocas & Andrew D. Selbst, *Big Data's Disparate Impact*, 104 CALIF. L. REV. 671 (2016) (noting the explosion of data in everyday life because of the Internet and highlighting the potential discriminatory effects of data mining); Dirk A. Zetsche et al., *From FinTech to TechFin: The Regulatory Challenges of Data-Driven Finance* (Eur. Banking Inst., Working Paper No. 6, 2017), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2959925 [<https://perma.cc/LW3B-QRT2>] (noting the ability of fintech firms to leverage data for their own business uses).

130. See ASHCRAFT & SCHUERMAN, *supra* note 83, at 3–12 (discussing the “seven key frictions” involved in the securitization process as well as the failure of actors to properly collect information in the run-up to the 2008 crisis); U.S. FIN. CRISIS INQUIRY COMM'N, *THE FINANCIAL CRISIS INQUIRY REPORT* 28 (2011); Mark J. Flannery et al., *Credit Default Swap Spreads as Viable Substitutes for Credit Ratings*, 158 U. PA. L. REV. 2085, 2086–95 (2010); see also Frank Partnoy, *The Siskel and Ebert of Financial Markets?: Two Thumbs Down for the Credit Rating Agencies*, 77 WASH. U. L.Q. 619, 664–70 (1999).

131. See HE ET AL., *supra* note 19, at 7–8.

132. See DELOITTE CTR. FOR FIN. SERVS., *ALTERNATIVE DATA FOR INVESTMENT DECISIONS: TODAY'S INNOVATION COULD BE TOMORROW'S REQUIREMENT* 4–9 (2017), <https://www2.deloitte.com/content/dam/Deloitte/us/Documents/financial-services/us-fsi-dcfs-alternative-data-for-investment-decisions.pdf>.

133. See *Data and Analytics in Financial Services*, PwC, <https://www.pwc.com/us/en/industries/financial-services/research-institute/top-issues/data-analytics.html> [<https://perma.cc/NB5F-XU2Z>]; see also *Analytics Activators for Financial Services*, BOS. CONSULTING GRP., <https://www.bcg.com/industries/financial-institutions/center-digital-financial-services/analytics-activators.aspx> [<https://perma.cc/XRP5-AH4S>].

134. Barocas & Selbst, *supra* note 129, at 673–74 (listing ways in which “Big Data” can be used).

135. See FRANK PASQUALE, *THE BLACK BOX SOCIETY: THE SECRET ALGORITHMS THAT CONTROL MONEY AND INFORMATION* 19–25 (2015); ERIC SCHMIDT & JARED COHEN, *THE NEW DIGITAL AGE: RESHAPING THE FUTURE OF PEOPLE, NATIONS AND BUSINESS* 1–11 (2013).

product of more sources of data, from mobile technologies to satellites and drones.¹³⁶

The growing availability of new and seemingly limitless quantities of data is enhanced by the structural assistance of what is conventionally referred to as the “cloud.”¹³⁷ Cloud storage allows large volumes of information to be stored cheaply on external, third-party, Internet-based servers. Instead of buying servers—which occupy physical space and necessitate maintenance expenses—to store data on-premises, firms can look to specialist third party providers of cloud storage to perform this all-important function for them. By storing data digitally in the cloud, users can generate and synthesize new data unimaginable a generation ago.¹³⁸

Potentially consolidating these advances structurally is blockchain, or distributed-ledger technology. Designed to enable the sharing and verification of data between a network of actors, blockchains represent operating systems that allow information to be organized within “block[s]” or “ledger[s]” of transaction data that can facilitate digital representation of entitlements and ownership.¹³⁹

A key innovation of blockchain systems lies in their capacity to decentralize the process by which information about transactions is collected and verified. Conventional methods of collecting data typically look to a central player—such as an exchange or a bank—to collect a batch of data, verify it, and vouch for its accuracy. Using blockchain, however, the need for this central intermediary can be reduced. Blockchain operating systems can be programmed to collect certain data from users (for example, date of birth and password), to check this data against established parameters (for example, stored information about users’ birthdays and passwords), and to then green-light the transaction when this data is verified as authentic.¹⁴⁰ As users enter required information into the system to begin a transaction (for example, to send a payment), multiple such transaction requests are organized into blocks or batches, verified, and then accepted into the “ledger,” or the definitive record of approved transactions for the payment

136. See Rob Mannix & Luke Smolinski, *Quant Funds Look Past the Obvious for Uses of Alternative Data*, RISK (Nov. 15, 2017), <https://www.risk.net/asset-management/5357531/quant-funds-look-past-the-obvious-for-uses-of-alternative-data> [<https://perma.cc/A7EQ-MYQW>] (noting that data can be “gleaned from social media, mobile apps, business records, satellites and drones”).

137. See FORESIGHT, U.K. GOV’T OFFICE FOR SCL, *THE FUTURE OF COMPUTER TRADING IN FINANCIAL MARKETS: AN INTERNATIONAL PERSPECTIVE* 30–32 (2012) (highlighting the essential role of cloud computing and its ability to sharply lower the costs of storing and accessing data).

138. See Paul M. Schwartz, *Legal Access to the Global Cloud*, 118 COLUM. L. REV. 1681 (2018) (noting difficulties entailed in the international regulation of sharing data through the cloud); Michael Fimin, *Emerging Cloud Trends in the Financial Sector: Cloud Adoption Soars, Yet Security Concerns Remain*, FINTECH WEEKLY (Apr. 13, 2017), <https://magazine.fintechweekly.com/magazine/articles/emerging-cloud-trends-in-the-financial-sector-cloud-adoption-soars-yet-security-concerns-remain> [<https://perma.cc/66RM-9MFS>].

139. See, e.g., Mike Orcutt, *Why America’s Biggest Bank Digs Cryptocurrency*, MIT TECH. REV. (Nov. 24, 2017), <https://www.technologyreview.com/s/609481/why-americas-biggest-bank-digs-anonymous-cryptocurrency/> [<https://perma.cc/Z389-CYYP>].

140. See BANK FOR INT’L SETTLEMENTS, *DISTRIBUTED LEDGER TECHNOLOGY IN PAYMENT CLEARING AND SETTLEMENT: AN ANALYTICAL FRAMEWORK* 4 (2017), <https://www.bis.org/cpmi/publ/d157.pdf>.

system.¹⁴¹ In this way, the need for a “central” bank as data collector and verifier is diminished. Instead, the system operates in a decentralized manner, allowing for data to be entered by multiple users and for the system to essentially automate the checking and approval process.¹⁴²

When such operating systems are decentralized, no one person monopolizes either data entry or verification. Instead, the creation and integrity of information on the blockchain is continuously validated by networked computers in accordance with a preset protocol and secured using cryptography. Whenever a new “block” of transactional data is introduced into the network—for example, to make a funds transfer between users in a payment system—previous data entries are updated as long as this information passes the blockchain’s verification protocols.¹⁴³

Collectively these developments are enabling the production of not only more data than in the past, but also *new* kinds of metadata and secondary data not previously accessible (or in existence). Fintech firms can scour the Internet, including social media as well as cellphone records, for insight into customers. Cloud software applications can help create secondary data based on the analysis and mining of original data. Further, by introducing networked communities, blockchains present the possibility of qualitatively new metadata based on the verifications performed on original data and its analytics.¹⁴⁴

In principle, these developments offer a range of benefits. With this variety and bulk of data capable of being accessed and stored (subject, of course, to applicable rules governing data collection and privacy), regulators and firms should have nuanced insight into markets. Finance firms are no longer restricted to collecting conventional types of hard data, such as a prospective borrower’s income or debt. Rather, they can rely on these data points as well as a host of more diffuse and new informational sources—for example, a borrower’s record of social media

141. *See id.* at 2–9.

142. *See id.* This description is a very basic summary of distributed ledger technology (DLT) and much more can be written in relation to the benefits, risks, and effectiveness of such systems for various types of transactions (for example, payments and securities settlement). Proposed blockchain systems can be private or public to varying degrees. *See id.* at 7. For example, a private blockchain system may only give access to a defined set of users and may rely on a firm (like a bank) to administer it and be liable for any errors. By contrast, certain blockchain systems, notably those underlying Bitcoin, are public and quintessentially decentralized where the system is designed to operate without a central authority to be responsible for the integrity of the system. For further description and analysis, *see id.*

143. *See* Zach Church, *Blockchain, Explained*, MIT DIGITAL (May 29, 2017), <http://ide.mit.edu/news-blog/blog/blockchain-explained> [https://perma.cc/649L-N86P]. In a funds transfer, once the data is checked by the network, one user’s account will show a debit entry and another’s a credit by the same amount. In this way, corrupt data at point “A” cannot become part of the chain because it will not match up with the equivalent data at points “B” and “C.” Once verified, the new record is then reviewable by everyone within the network and can be made immutable to provide certainty. *See id.*

144. *See* INT’L COMM. ON CREDIT REPORTING, *USE OF ALTERNATIVE DATA TO ENHANCE CREDIT REPORTING TO ENABLE ACCESS TO DIGITAL FINANCE SERVICES BY INDIVIDUALS AND SMES OPERATING IN THE INFORMAL ECONOMY* (2018), https://www.g20.org/sites/default/files/documentos_producidos/use_of_alternative_data_to_enhance_credit_reporting_to_enable_access_to_digital_financial_services_iccr.pdf. For these reasons banks and other financial institutions have increasing interest in the potential of blockchain technologies. *See* Orcutt, *supra* note 139.

use or online purchases.¹⁴⁵ Aided by information contained in devices such as cellphones or tablets, online lenders can discern customer behavior using apps and convenient online interfaces.¹⁴⁶ With more data to offer, borrowers that may once have been shunned from credit markets might now see themselves more fully included within the financial system. Simply relying on FICO scores or established credit histories might exclude communities that have historically lacked access to credit or financial services. A broader and more diverse set of data—including a user’s social contacts or shopping habits—may allow opportunities to foster greater inclusion in credit markets.¹⁴⁷

A thicker informational market can also lead to efficient outcomes for regulators. Instead of struggling to obtain information from paper-based dealings, cash transactions, or face-to-face interactions, digital records offer a better means of preserving data about financial transactions and surveilling markets for illegal or risky dealings.¹⁴⁸ Furthermore, digital information sources lend themselves to being collated, computed, and modeled as a basis for understanding the state of the market and predicting future risk.

But there are also reasons for caution. For one, finding statistical connections and meaning within large datasets is far from straightforward, and regulators and market participants can face high analytical costs in cleaning, collating, interpreting, and handling vast stores of data.¹⁴⁹ These costs, particularly for resource-constrained regulators, can motivate supervisors to rely on those they supervise for insight into data mining and interpretation, raising obvious concerns of capture.¹⁵⁰

145. See Tammer Kamel, *Alternative Data—The Developing Trend in Financial Data*, QUANDL BLOG (Apr. 12, 2016), <https://blog.quandl.com/alternative-data> [<https://perma.cc/2792-BX5H>]. There is enormous debate and ongoing discussion regarding the capacity of firms to collect and share detailed data about consumers. See, e.g., Sherisse Pham, *Facebook Defends Sharing User Data with Phone Makers*, CNN (June 4, 2018, 12:18 PM), <https://money.cnn.com/2018/06/04/technology/facebook-apple-samsung-blackberry/index.html> [<https://perma.cc/MT7E-YCZ3>]; Olivia Solon, *How Europe’s ‘Breakthrough’ Privacy Law Takes on Google and Facebook*, THE GUARDIAN (Apr. 19, 2018, 3:01 AM), <https://www.theguardian.com/technology/2018/apr/19/gdpr-facebook-google-amazon-data-privacy-regulation> [<https://perma.cc/9E8V-XDP6>].

146. See Charles Lane, *Will Using Artificial Intelligence to Make Loans Trade One Kind of Bias for Another?*, NPR (Mar. 31, 2017, 5:06 AM), <https://www.npr.org/sections/alltechconsidered/2017/03/31/521946210/will-using-artificial-intelligence-to-make-loans-trade-one-kind-of-bias-for-anot> [<https://perma.cc/HH4Z-MVYN>].

147. See, e.g., Julapa Jagtiani & Catharine Lemieux, *Fintech Lending: Financial Inclusion, Risk Pricing, and Alternative Information* 1, 7–17 (Fed. Reserve Bank of Phila., Working Paper No. 17–17, 2017) <https://www.philadelphiafed.org/-/media/research-and-data/publications/working-papers/2017/wp17-17.pdf> (noting the potential for alternative data to improve financial inclusion).

148. See Kamel, *supra* note 145.

149. See generally Barocas & Selbst, *supra* note 129 (describing how the proliferation of data and data mining can have discriminatory effects).

150. See Christopher Slobogin, *Government Data Mining and the Fourth Amendment*, 75 U. CHI. L. REV. 317, 317–21 (2008) (discussing the use of private “data brokers” to collect data as part of intensive data mining); see also Kiel Brennan-Marquez, *The Constitutional Limits of Private Surveillance*, 66 KAN. L. REV. 485 (2018) (discussing the “fusion of private surveillance and public law enforcement” as enforcement becomes increasingly data-driven).

Alternatively, digital datasets can lead to disparate and even unfair outcomes for would-be clients and customers. Historically disadvantaged minority communities, for example, could fare worse, not better, under some analytical systems dependent on longstanding records of using banking and insurance services.¹⁵¹ Where the availability of data is limited due to the de jure or de facto exclusion of such subgroups from credit systems, some lending algorithms may infer that higher interest rates and tighter credit conditions are warranted, and impose such terms accordingly. Such communities may also find themselves especially vulnerable to invasions of privacy and the accessing of sensitive data.¹⁵²

Information can also be inaccurate. “Fake news” on the Internet can be rapidly impounded, without verification, into the total mix of data consumed by the market and analytical models. Data generated from websites, blogs, and social media can be incorrect, fraudulent, or ambiguous.¹⁵³ When disinformation filters into data gathering processes, it taints their quality and reliability. As a result, data sourced from the web can ultimately cause faulty analysis, even when powerful technological tools and verification mechanisms are brought to bear, a point we will revisit below.¹⁵⁴

B. FROM AUTOMATION TO MACHINE LEARNING

A second signature feature of fintech lies in the increasing prevalence and centrality of automation and machine learning. Algorithms—or programmed

151. See Jagtiani & Lemieux, *supra* note 147, at 9.

152. See *id.*; see also Jane Bambauer, *Is Data Speech?*, 66 STAN. L. REV. 57, 100–05 (2014) (discussing regulatory controversies in relation to the relative protectiveness of data privacy regimes); Robert Bartlett et al., *Consumer-Lending Discrimination in the Era of FinTech* (Working Paper, Oct. 2018), <https://faculty.haas.berkeley.edu/morse/research/papers/discrim.pdf>. Jurisdictions can vary in the intensity of the protection accorded to personal data. See, e.g., Daisuke Wakabayashi, *California Passes Sweeping Law to Protect Online Privacy*, N.Y. TIMES (June 28, 2018), <https://www.nytimes.com/2018/06/28/technology/california-online-privacy-law.html> [<https://nyti.ms/2IEdwDX>] (discussing a 2018 California law granting customers greater rights to control their digital data).

The literature and analysis in this area is vast. See, e.g., EUROPEAN PARLIAMENT, A COMPARISON BETWEEN US AND EU DATA PROTECTION LEGISLATION FOR LAW ENFORCEMENT (2015), [http://www.europarl.europa.eu/RegData/etudes/STUD/2015/536459/IPOL_STU\(2015\)536459_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/STUD/2015/536459/IPOL_STU(2015)536459_EN.pdf) (discussing divergences between the E.U. and U.S. privacy regimes); Lucy Handley, *US Companies Are Not Exempt from Europe's New Data Privacy Rules—And Here's What They Need to Do About It*, CNBC (Apr. 25, 2018, 5:43 AM), <https://www.cnbc.com/2018/04/25/gdpr-data-privacy-rules-in-europe-and-how-they-apply-to-us-companies.html> [<https://perma.cc/JDS2-SHDK>].

153. See, e.g., Alina Selyukh, *Hackers Send Fake Market-Moving AP Tweet on White House Explosions*, REUTERS (Apr. 23, 2013, 1:31 PM), <https://www.reuters.com/article/net-us-usa-whitehouse-ap/hackers-send-fake-market-moving-ap-tweet-on-white-house-explosions-idUSBRE93M12Y20130423> [<https://perma.cc/RR72-LCMK>].

154. See, e.g., Kimberly N. Brown, *Outsourcing, Data Insourcing, and the Irrelevant Constitution*, 49 GA. L. REV. 607, 609–15, 620–21, 632–33 (2015) (describing the practice of “data insourcing” in the context of the reliance placed by government authorities on private firms); Andrew Guthrie Ferguson, *Big Data and Predictive Reasonable Suspicion*, 163 PA. L. REV. 327, 331–36 (2015) (discussing how the use of data by law enforcement “undermines the protection that reasonable suspicion provides against police stops and potentially transforms reasonable suspicion into a means of justifying those same stops”).

computerized instructions—form the operational basis for financial products that exhibit high degrees of automation and artificial intelligence (AI) in their workings.¹⁵⁵

Automation has long been a key goal in the delivery of financial services. Since the 1970s, market participants have relied on algorithms to enable greater speed and sophistication and to increase automation in their transactions.¹⁵⁶ The rise of the Internet, digitization, big data, and computational power has facilitated an unprecedented flourishing of algorithms in markets, newly bringing AI and machine learning to financial transactions and decisionmaking.¹⁵⁷ Using AI, algorithms now routinely perform tasks and produce outcomes that appear “smart,” mimicking humanlike feats of logic and deduction.¹⁵⁸ This “intelligence” has deepened over time as algorithms have become adept at processing natural language, images (for example, faces), and attaching meaning to data.¹⁵⁹

The emergence of a subset of algorithms that specialize in machine learning enhanced this development. Such learning algorithms are defined by their capacity to decompose and organize large swaths of data, derive patterns from

155. See THOMAS H. CORMEN ET AL., INTRODUCTION TO ALGORITHMS 5–6 (3d ed. 2009) (“Informally, an *algorithm* is any well-defined computational procedure that takes some value, or set of values, as *input* and produces some value, or set of values, as *output*. An algorithm is thus a sequence of computational steps that transform the input into the output.”); John Bates, *Algorithmic Trading and High Frequency Trading: Experiences from the Market and Thoughts on Regulatory Requirements*, in U.S. COMMODITY FUTURES TRADING COMM’N, TECH. ADVISORY COMM., TECHNOLOGICAL TRADING IN THE MARKETS (2010) http://www.cftc.gov/ucm/groups/public/@newsroom/documents/file/tac_071410_binder.pdf (“An algorithm is ‘a sequence of steps to achieve a goal.’”); see also FORESIGHT, *supra* note 137, at 19–38; JEFFREY G. MACINTOSH, HIGH FREQUENCY TRADERS: ANGELS OR DEVILS? 2–8 (2013), https://www.cdhowe.org/sites/default/files/attachments/research_papers/mixed/Commentary_391_0.pdf (describing how “high frequency trading,” or “the use of extremely high speed computers and automated trading algorithms to trade high volumes of stock at lightning speed,” works and how it has “transformed world capital markets”); CATHY O’NEIL, WEAPONS OF MATH DESTRUCTION: HOW BIG DATA INCREASES INEQUALITY AND THREATENS DEMOCRACY 10–13 (2016) (discussing the extensive reliance on algorithms in finance and ordinary life).

156. See, e.g., Joel Hasbrouck et al., *New York Stock Exchange Systems and Trading Procedures* (N.Y. Stock Exch., Working Paper No. 93-01, 1993), <http://people.stern.nyu.edu/jhasbrou/Research/Working%20Papers/NYSE.PDF> (discussing the NYSE’s use of an automated ordering system—the Designated Order Turnaround (DOT)—in the 1970s and the evolution of its order entry and processing systems in the 1990s); *Machine-Learning Promises to Shake Up Large Swathes of Finance*, THE ECONOMIST (May 25, 2017), <https://www.economist.com/finance-and-economics/2017/05/25/machine-learning-promises-to-shake-up-large-swathes-of-finance> [<https://perma.cc/S5F5-KFB7>] [hereinafter *Machine-Learning Promises*] (noting that “[m]achine-learning is already much used for tasks such as compliance, risk management and fraud prevention”); Bob Pisani, *Man vs. Machine: How Stock Trading Got So Complex*, CNBC (Sept. 13, 2010, 6:03 PM), <https://www.cnbc.com/id/38978686> [<https://perma.cc/T4EC-PMWR>] (describing the timeline of the NYSE moving from DOT to SuperDot).

157. See U.S. FIN. STABILITY BD., ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN FINANCIAL SERVICES: MARKET DEVELOPMENTS AND FINANCIAL STABILITY IMPLICATIONS 3–7 (2017), <http://www.fsb.org/wp-content/uploads/P011117.pdf>.

158. See *id.* at 4–5.

159. See, e.g., Jack M. Balkin, *The Path of Robotics Law*, 6 CALIF. L. REV. CIR. 45 (2015) (discussing the impact of robotics and artificial intelligence on reshaping legal paradigms); Ryan Calo, *Robotics and the Lessons of Cyberlaw*, 103 CALIF. L. REV. 513, 514–20 (2015) (noting how robotics challenges core concepts and machinations of the law).

this information, and gradually “learn” over time from the quality of the outputs they produce.¹⁶⁰ In effect, machine-learning algorithms are programmed to reprogram themselves over time in response to new data and the external validation garnered by their performance.¹⁶¹ Using data and ever cheaper access to high-quality computational power, machine-learning algorithms can apply sophisticated models and processing techniques (for example, neural networks) to achieve informed, creative, and precise results.¹⁶² With algorithms capable of evaluating the quality of their actions and adjusting their performance to reflect new data, automation becomes possible without the need for real-time human intervention.¹⁶³

AI and machine learning are quickly reshaping and reimagining financial services. For example, they have gained a deep foothold in automating the processes by which securities are bought and sold. Although the trading process has long relied on technology (for example, the NYSE’s central quotation system), AI has enabled technology to almost fully automate the trading process. Trading firms rely on preprogrammed algorithms to make real-time, trade-by-trade determinations about what to buy and sell—in increments measured in milliseconds and microseconds.¹⁶⁴ Showcasing degrees of AI, high-frequency trading algorithms respond dynamically to changing market conditions as prices for stocks and bonds constantly adjust to new information on a millisecond-by-millisecond basis.¹⁶⁵ High-frequency trading (HFT) is now ubiquitous, responsible for around fifty to seventy percent of equity trading by volume, sixty percent of futures, and

160. See U.S. FIN. STABILITY BD., *supra* note 157, at 4.

161. See *id.* at 4–5; Steven Levy, *How Google Is Remaking Itself as a “Machine Learning First” Company*, WIRED (June 22, 2016, 12:00 AM), <https://www.wired.com/2016/06/how-google-is-remaking-itself-as-a-machine-learning-first-company/> [<https://perma.cc/D9XD-L24G>]; see also Ryan Calo, *Artificial Intelligence Policy: A Primer and Roadmap*, 51 U.C. DAVIS L. REV. 399, 405–10 (2017).

162. See Calo, *supra* note 161, at 405. Neural nets, for example, refer to a data processing technique that deploys programming that mimics the layered thinking utilized by human brains. See Levy, *supra* note 161. For further discussion of the use of machine learning and deep learning, see Richard Waters, *Techmate: How AI Rewrote the Rules of Chess*, FIN. TIMES (Jan. 12, 2018), <https://www.ft.com/content/ea707a24-f6b7-11e7-8715-e94187b3017e> [<https://perma.cc/W5H8-8K24>].

163. See, e.g., Erin Winick, *Lawyer-Bots Are Shaking Up Jobs*, MIT TECH. REV. (Dec. 12, 2017), <https://www.technologyreview.com/s/609556/lawyer-bots-are-shaking-up-jobs/> [<https://perma.cc/VWK3-D3M7>] (describing how “AI-powered document discovery tools” have the capacity to “learn to flag the appropriate sources a lawyer needs to craft a case, often more successfully than humans”).

164. See MACINTOSH, *supra* note 155, at 3–7; see also INT’L ORG. OF SEC. COMM’NS, REGULATORY ISSUES RAISED BY THE IMPACT OF TECHNOLOGICAL CHANGES ON MARKET INTEGRITY AND EFFICIENCY: CONSULTATION REPORT 10 (2011), <http://www.iosco.org/library/pubdocs/pdf/IOSCOPD354.pdf>.

165. According to a study by the Australian Securities and Investments Commission, 99.6% of trading messages for share trading on Australian markets originated from automated trading systems. See AUSTRAL. SEC. & INVS. COMM’N, DARK LIQUIDITY AND HIGH-FREQUENCY TRADING 73 (2013), <https://download.asic.gov.au/media/1344182/rep331-published-18-March-2013.pdf>; see also Michael Kearns & Yuriy Nevmyvaka, *Machine Learning for Market Microstructure and High-Frequency Trading*, in HIGH-FREQUENCY TRADING 91, 122–23 (David Easley, Marcos López de Prado & Maureen O’Hara eds., 2013) (highlighting the rise of machine learning in high-frequency trading).

over fifty percent of trading by volume in the all-important U.S. Treasuries market.¹⁶⁶

Indeed, in today's markets, AI is being engineered into cryptographic, distributed ledger (or blockchain) operating systems to amplify their usefulness. Cryptocurrencies are building AI into their protocols to offer users a means of automating payments and transferring value in accordance with instructions that users can tailor and preprogram. For example, the Ethereum platform—using the virtual currency “Ether”—showcases an express ambition to situate its value-transfer mechanism within the operation of so-called “smart contracts.”¹⁶⁷ Users can preprogram smart contracts to specify the exact conditions under which a payment in Ether should occur. For example, a smart contract might codify an agreement between users for one to transfer value to another in relation to a defined event (for example, after purchasing a car). A smart contract could be programmed to connect to data within the Ethereum blockchain (for example, information that certifies the proof of car purchase) and automatically transfer payment in Ether between users once this condition is met and verified. Indeed, users might program smart contracts to settle a position on the price of a certain asset (for example, wheat or Google shares), necessitating that smart contracts use AI for stock market data collection and analysis.¹⁶⁸ It remains early days for this kind of AI-based virtual currency system. But beyond aiming to simply transfer value, the extension of AI into virtual payment systems aspires to automate the

166. See RINA S. MILLER & GARY SHORTER, CONG. RESEARCH SERV., HIGH FREQUENCY TRADING: OVERVIEW OF RECENT DEVELOPMENTS (2016), <https://fas.org/sgp/crs/misc/R44443.pdf>; Michael Mackenzie, *High Frequency Trading Under Scrutiny*, FIN. TIMES (July 28, 2009) <https://www.ft.com/content/d5fa0660-7b95-11de-9772-00144feabdc0> [<https://perma.cc/8ZT4-Y7HL>] (noting that HFT equity volume was over seventy percent).

The definition of what constitutes HFT is notoriously imprecise. The SEC, for example, points to certain identifying factors, including: use of “extraordinarily” high speeds for executing and routing trades, close location between exchanges and servers of trading firms, and very short time frames for holding positions. See STAFF OF DIV. OF TRADING & MKTS., U.S. SEC. & EXCH. COMM’N, EQUITY MARKET STRUCTURE LITERATURE REVIEW: PART II: HIGH FREQUENCY TRADING 4–5 (2014), https://www.sec.gov/marketstructure/research/hft_lit_review_march_2014.pdf; see also FORESIGHT, *supra* note 137, at 27–38; MACINTOSH, *supra* note 155, at 2–7; Alexander Osipovich, *Algorithmic Trading in Energy Markets: A Different Ball Game*, RISK (Jan. 10, 2012), <https://www.risk.net/risk-management/2136141/algorithmic-trading-energy-markets> [<https://perma.cc/W2GL-E22F>]; Philip Stafford et al., *NASDAQ Sets Stage for HFT in Treasuries*, FIN. TIMES (Apr. 4, 2013), <https://www.ft.com/content/6e0ac4de-9d08-11e2-a8db-00144feabdc0> [<https://perma.cc/T4UD-A3JY>].

167. See *A Next-Generation Smart Contract and Decentralized Application Platform*, GITHUB <https://github.com/ethereum/wiki/wiki/White-Paper> [<https://perma.cc/E9PN-K43K>] (last visited Oct. 29, 2018). In this way, Ethereum’s aspiration to allow programmable smart contracts in tailored ways distinguishes it from Bitcoin, which primarily focuses on automating the transfer of value. See Alyssa Hertig, *How Do Ethereum Smart Contracts Work?*, COINDESK, <https://www.coindesk.com/information/ethereum-smart-contracts-work/> [<https://perma.cc/9X5E-NA4V>] (last visited Oct. 29, 2018). For discussion on smart contracts and the application of contract law theory, see Usha R. Rodrigues, *Law and the Blockchain* (Univ. of Ga. Sch. of Law, Research Paper No. 2018-07, 2018) (noting that smart contracts may fail to reflect the reality of incomplete contracting).

168. See Max Raskin, *The Law and Legality of Smart Contracts*, 1 GEO. L. TECH. REV. 305, 316–20 (2017) (discussing the role of smart contract in blockchain-based systems).

codification, verification, and settlement of a broad variety of everyday transactions.¹⁶⁹

AI is also transforming financial functions such as retail investments and credit. Robo advising businesses like Betterment, discussed in the Introduction to this Article, emphasize and leverage their expertise in AI and machine learning to help clients allocate savings.¹⁷⁰ These kinds of digital advisors deploy algorithms to crunch client information and risk preferences to allocate their capital to the most suitable investment opportunities. AI can be applied to collect and parse data and to analyze past performance and investment strategies to allocate customer funds, harnessing computational ability beyond the capacity of human professionals acting alone.¹⁷¹ Although still relatively nascent and representing only a small slice of the overall investment advisory market, robo advisory firms are seeing rapid growth and increasing visibility.¹⁷²

Similarly, algorithms are showcasing an ever greater capacity to collect and analyze big data in credit markets.¹⁷³ AI algorithms cast a broad net to catch a much larger (and often nonstandard) variety of data points than those used by earlier generations of lenders. As observed above, AI algorithms track, for example,

169. Shortcomings and risks have been noted in the operation of smart contracts—for example, in relation to incentivizing “automated” fraudulent schemes. See, e.g., Klint Finley, *A \$50 Million Hack Just Showed That the DAO Was All Too Human*, WIRED (June 18, 2016, 4:30 AM), <https://www.wired.com/2016/06/50-million-hack-just-showed-dao-human/> [<https://perma.cc/4NAX-H4K7>] (describing a damaging Ether hack); Izabella Kaminska, *It's Not Just a Ponzi, It's a 'Smart' Ponzi*, FIN. TIMES: ALPHAVILLE (June 1, 2017, 8:42 AM), <https://ftalphaville.ft.com/2017/06/01/2189634/its-not-just-a-ponzi-its-a-smart-ponzi/> [<https://perma.cc/M47V-GNCX>].

170. See Dan Egan, *Get All the Returns You Deserve*, BETTERMENT (May 10, 2018), <https://www.betterment.com/resources/investment-strategy/investor-returns/> [<https://perma.cc/7SYK-CSMN>].

171. Cf. *id.*

172. See BARBARA NOVICK ET AL., BLACKROCK, DIGITAL INVESTMENT ADVICE: ROBO ADVISORS COME OF AGE (2016), <https://www.blackrock.com/corporate/literature/whitepaper/viewpoint-digital-investment-advice-september-2016.pdf> (noting that although “digital advisors represent a very small segment relative to more traditional financial advice providers, their recent rapid growth suggests a need for a focused analysis of the business and activities of these advisors”); Arielle O’Shea & Anna-Louise Jackson, *Best Robo-Advisors: 2018 Top Picks*, NERDWALLET (Jan 9, 2018), <https://www.nerdwallet.com/blog/investing/best-robo-advisors/> [<https://perma.cc/D8QQ-SZ5S>] (compiling a list of the top robo advisors); see also Gary Brackenridge, *Machine Learning is Transforming Investment Strategies for Asset Managers*, CNBC (June 6, 2017, 8:01 AM), <https://www.cnbc.com/2017/06/06/machine-learning-transforms-investment-strategies-for-asset-managers.html> [<https://perma.cc/49L5-CT9T>]; Nishant Kumar, *How AI Will Invade Every Corner of Wall Street*, BLOOMBERG (Dec. 5, 2017, 2:00 AM), <https://www.bloomberg.com/news/features/2017-12-05/how-ai-will-invade-every-corner-of-wall-street> [<https://perma.cc/XN2W-P4FV>]; *Machine-Learning Promises*, *supra* note 156. For an overview of the increase of robo advisory firms and corresponding challenges in the European financial sector, see EUROPEAN COMM’N, FINTECH: A MORE COMPETITIVE AND INNOVATIVE EUROPEAN FINANCIAL SECTOR 7–8 (2017), https://ec.europa.eu/info/sites/info/files/2017-fintech-consultation-document_en_0.pdf, and EUROPEAN BANKING AUTH., EBA RESPONSE TO THE EC CONSULTATION DOCUMENT ON FINTECH: A MORE COMPETITIVE AND INNOVATIVE EUROPEAN FINANCIAL SECTOR 1–4 (2017), <http://www.eba.europa.eu/documents/10180/187341/EBA+response+to+the+European+Commission+Consultation+Document+on+FinTech+-+June+2017.pdf>. For additional analysis of the risks and benefits of robo advising, see Baker & Dellaert, *supra* note 13.

173. See generally Jagtiani & Lemieux, *supra* note 147 (discussing the impact of fintech lenders in credit markets).

a borrower's social media, contacts, personal habits (including esoteric variables such as punctuation quality in text messages), hobbies, SAT scores, and shopping preferences. Some digital lenders require borrowers to download an app to their cellphone whose algorithms can collect the vast reserves of stored data in the device (for example, social contacts).¹⁷⁴ Capturing this multiplicity of "alternative data" is made possible by the aid of algorithms that can track and parse this information across sources, draw out patterns, and determine the best course of action to take based on programming and past learning.¹⁷⁵

Collectively, these developments suggest a not-too-distant future in which AI becomes capable of directly connecting Main Street lending to the rarified world of Wall Street financial engineering discussed in Part II. Past eras of innovation witnessed the growth of securitization and credit default swaps linked to commercial loans and mortgage-backed securities. Bankers (using spreadsheets and computation, certainly) analyzed home or auto loan data to decide which loans to package into investment vehicles. Looking ahead, AI algorithms might determine the borrowers to whom bankers lend (using alternative data discussed above). Based on the likelihood of repayment and anticipated future cash flows, algorithms may then suggest what kinds of credit protection bankers ought to buy. Indeed, AI can more fully automate the processes by which banks hedge the risks of their loan book. Noting what kinds of loans a bank is funding (for example, mortgages), algorithms can take steps to find and purchase the most optimal instruments with which to hedge this risk (for example, interest rate swaps or credit default swaps).¹⁷⁶ Outside of risk management, AI might also allocate surplus cash flows from these bank loans to invest in potentially profitable ventures (for example, to invest in commercial real estate or emerging market debt).¹⁷⁷

But AI and machine-learning algorithms also raise dangers for markets. First, the proper workings of algorithms depend on the input of clear, correct, and codable data. When algorithms access informational sources (like alternative data) that are ambiguous, falsified, or overly noisy, their output will be tainted by error and thus unreliable.¹⁷⁸ Moreover, automation means that the impact of such misfiring can spread widely as algorithms respond automatically to new information.

174. See U.S. FIN. STABILITY BD., *supra* note 157, at 12–13; Lane, *supra* note 146.

175. According to one estimate, there may be around 2,000 digital lending startups in the credit market, a portion of which use artificial intelligence and machine learning to work. Lane, *supra* note 146.

176. For a discussion of swaps and securitization, see generally *supra* notes 81–86 and accompanying text.

177. See, e.g., Katy Burne, *ICE Launches Electronic Trading Network for Credit-Default Swaps*, WALL ST. J. (Jan. 27, 2014, 1:09 PM), <https://www.wsj.com/articles/ice-launches-electronic-trading-network-for-creditdefault-swaps-1390845869> [<https://perma.cc/3DT4-UVG7>].

178. See, e.g., Peter Foster, "Bogus" AP Tweet About Explosion at the White House Wipes Billions off US Markets, THE TELEGRAPH (Apr. 23, 2013, 6:38 PM), <https://www.telegraph.co.uk/finance/markets/10013768/Bogus-AP-tweet-about-explosion-at-the-White-House-wipes-billions-off-US-markets.html> [<https://perma.cc/E6TJ-Q77U>]; Renae Merle, *How "Fake News" is Affecting Trading Algorithms*, CNBC (July 5, 2017, 4:49 PM), <https://www.cnbc.com/video/2017/07/05/how-fake-news-is-affecting-trading-algorithms.html> [<https://perma.cc/7H4F-3MG4>].

Without checking the veracity of data or waiting for real-time human verification, automated algorithms can cause the amplification of bad information when used by multiple programs or perhaps in smart contracts.¹⁷⁹

Second, AI and machine-learning programs are only as good as the quality and completeness of their programming. When this programming is deficient or vulnerable to error, costs will inevitably accrue. Notably, algorithms may struggle to respond to market environments that are not anticipated by their programming or when there is insufficient data for an algorithm to arrive at credible predictions. If markets are in turmoil, as exemplified by Betterment, automated algorithms may either be forced to withdraw from the market or risk generating suboptimal or damaging results from their operations.¹⁸⁰ In such cases, their performance may end up exacerbating crises rather than facilitating efficiencies in the market.¹⁸¹

Finally, complex AI and machine-learning algorithms impose high informational costs on regulators. Understanding the opaque “self-learning” processes of machine-learning algorithms presents a significant hurdle for policymakers seeking to craft regulatory measures to control the risks such technology might generate. Given the potential for automation to result in widespread, cascading costs, mapping the likely performance of sophisticated algorithms becomes especially necessary. When this task is computationally difficult or overly costly, regulators will be left with poorly adapted tools with which to tackle the dangers.

C. (DIS-)INTERMEDIATION OF INCUMBENT FIRMS AND INFRASTRUCTURE

The final distinguishing feature of fintech is not so much what it does, but *how* it does it. Unlike earlier eras during which innovation was often driven by established incumbents, fintech often gives a leading role to small, startups whose primary expertise can sometimes reside in tech rather than finance.¹⁸² In 2015 alone, U.S. fintech firms received investments of around \$27 billion out of approximately \$47 billion disbursed globally, highlighting the profit potential of finance as an industry ripe for “disruption” by tech.¹⁸³ In other words, it looked like innovative technologies could generate better efficiencies than those being offered by traditional financial firms.¹⁸⁴ This centrality of “outsider” firms contrasts sharply

179. See Alain P. Chaboud et al., *Rise of the Machines: Algorithmic Trading in the Foreign Exchange Market*, 69 J. FIN. 2045 (2014) (noting that HFT algorithms can amplify price impact in the foreign exchange market); Austin Gerig, *High-Frequency Trading Synchronizes Prices in Financial Markets* (Jan. 1, 2015) (unpunished manuscript) https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2173247 [<https://perma.cc/538Y-37HQ>] (noting that HFT markets are efficient at spreading information, including the impact of erroneous data).

180. See Wursthorn & Tergesen, *supra* note 9.

181. See *infra* Section II.D.

182. See Douglas W. Arner et al., *The Evolution of Fintech: A New Post-Crisis Paradigm?*, 47 GEO. J. INT'L LAW 1271 (2016).

183. KPMG, *THE PULSE OF FINTECH Q4 2016: GLOBAL ANALYSIS OF INVESTMENT IN FINTECH 5–9* (2017) (noting that investment in fintech fell in 2016 owing potentially to political uncertainties as well as perceived saturation of investment in payments and blockchain technologies).

184. See *generally id.*

with the historical dominance of brand-name Wall Street firms being the main movers in financial innovation, a state of affairs evident not only in the speculation of the 1920s, but also the derivatives markets of the 1990s and 2000s.¹⁸⁵

The ability of startups to compete with larger established counterparts stems from some of the dynamics and core features of fintech discussed earlier in sections II.A and II.B.¹⁸⁶ Advances in big data and machine learning have made it easier for many firms to cull or generate the information necessary for the delivery of competitive financial services. Automation and machine learning enable the delivery of financial services in ways more amenable for a new generation of tech-savvy and mobile consumers. Such innovations—only possible in the age of the Internet and reliable online data and payments processing—showcase the potential of fintech to erode the preeminence of traditional financial intermediaries. Robo advisors are taking business from traditional advisors and broker dealers; Person-to-Person (P2P) lending platforms from banking institutions; crowdfunding and ICOs from venture capital and investment banks; and so on.¹⁸⁷

At the same time, rather than fully disintermediating the entire financial processes, many fintech firms are targeting discrete parts of a financial supply chain. In other words, instead of actually lending money—and going through the work of underwriting and documenting loans—a fintech firm may produce a mobile app that connects to a customer's phone and downloads its data to the lender's computer systems. Another company, instead of financing a line of credit like a bank, may provide a simple digital wallet that allows customers to load money to it for purchases at one or many stores.¹⁸⁸

The rising cast of upstart firms and services need not always compete directly with incumbents. Instead, new firms may offer services and products that complement those offered by incumbents to create innovative supply chains for financial products. In scenarios such as these, entrant firms may wish to take advantage of

185. See, e.g., ASHCRAFT & SCHUERMAN, *supra* note 83, at 11–14 (noting that the chain of securitizations does include nonbank mortgage lenders that make loans and sell these into institutions in the more regulated financial sector); Eichengreen & Mitchener, *supra* note 54, at 9–11 (discussing speculation in the 1920s).

186. For example, intermediation traditionally played a significant role in finance. See John G. Gurley & Edward S. Shaw, *Financial Institutions and Interrelationships: Financial Intermediaries and the Saving-Investment Process*, 11 J. FIN. 257, 258–59 (1956); John G. Gurley & E.S. Shaw, *Financial Aspects of Economic Development*, 45 AM. ECON. REV. 515, 520–21 (1955); James Tobin, *Commercial Banks as Creators of "Money"* 3–4 (Cowles Found., Discussion Paper No. 159, 1963).

This view, however, is somewhat simplistic. See Robert C. Hockett & Saule T. Omarova, *The Finance Franchise*, 102 CORNELL L. REV. 1143, 1146 (2017) (“The intermediated-scarce-private-capital orthodoxy is a myth . . . markets do intermediate, but . . . that is not what they are mainly about.”); Zoltan Jakab & Michael Kumhof, *Banks are Not Intermediaries of Loanable Funds—and Why This Matters* (Bank of Eng., Working Paper No. 529, 2015), <https://www.bankofengland.co.uk/-/media/boe/files/working-paper/2015/banks-are-not-intermediaries-of-loanable-funds-and-why-this-matters.pdf>.

187. See, e.g., Chris Brummer, *Disruptive Technology and Securities Regulation*, 84 FORDHAM L. REV. 977, 1001, 1016 (2015); Andrew Verstein, *The Misregulation of Person-to-Person Lending*, 45 U.C. DAVIS L. REV. 445, 452–57 (2011); Lane, *supra* note 146; Ben McLannahan, *Lending Club Says Loans on the Rise as it Rebounds from Governance Scandal*, FIN. TIMES (Feb. 14, 2017), <https://www.ft.com/content/29f2462f-bd57-319c-97a4-9c28e7e7c005> [<https://perma.cc/BK4U-PPK5>].

188. Cf. Magnuson, *supra* note 20, at 1199–1204 (discussing the systemic risks of disintermediation).

the customer networks, access to capital, and expertise offered by incumbents with a long pedigree. For instance, fintech firms might team up with traditional or incumbent firms to facilitate new kinds of services for customers in their sectors.¹⁸⁹ For example, Ripple's XRP, a virtual currency, enables the transfer of value between banks and financial firms where the traditional system may be too slow, expensive, or unreliable.¹⁹⁰ Similarly, loans that are funded through P2P platforms or assumed on the books of a platform provider can be sold to mainstream banks or securitized. Such a sale creates space on the books of a P2P lender for further lending and provides cash to spur more credit. P2P lenders can thus rely on banks to share some of the risks and benefits of their core business.¹⁹¹

Incumbents may also try to adapt by offering a competing product or by directly funding and buying fintech firms. The robo advising industry, for instance, includes new entrants as well as established firms such as Fidelity, E-Trade, or T.D. Ameritrade that also offer automated advisory services.¹⁹² Banks have developed their own mobile payments and digital wallet products to match those offered by up-and-coming fintech entrepreneurs.¹⁹³ Additionally, prominent financial firms serve as incubators for fintech talent, putting new companies through their paces and offering pathways to partnership for those that come up with successful products and proofs of concept.¹⁹⁴

Collectively, these moves are transforming the ecosystem of financial services. Whereas earlier eras of finance saw incumbent firms comfortably provide "one-stop shops" to manage most aspects of a transaction, fintech is enabling an unprecedented degree of fragmentation in financial services as new firms compete with, collaborate with, and, in some instances, replace established incumbents. All along the value chain, financial services face a more heterogeneous and contested environment as tech experts target entire or discrete processes within a transaction.¹⁹⁵

189. See, e.g., *Apple Pay*, APPLE, <https://www.apple.com/apple-pay/> [<https://perma.cc/ZY9-82MG>] (last visited Oct. 29, 2018) (an example of digital payment technology that harnesses existing credit card and banking networks).

190. See *XRP: The Digital Asset for Payments*, RIPPLE, <https://ripple.com/xrp/> [<https://perma.cc/8Y55-4KK5>] (last visited Oct. 29, 2018) (offering banks and payment providers an option to "source liquidity for cross-border payments," with payments settling in four seconds compared to traditional systems that may take three to five days).

191. See Peter Rudegeair & Justin Baer, *Goldman, Jefferies Put LendingClub Deals on Hold; Banks' Review of Events Leading to Ouster of CEO Renaud Laplanche Could Jeopardize Securitization Deals*, WALL ST. J. (May 10, 2016, 10:48 PM), <https://www.wsj.com/articles/goldman-jefferies-pause-buying-lendingclub-loans-1462903699> [<https://perma.cc/HUW9-TXTK>].

192. See, e.g., Arielle O'Shea, *Best Robo-Advisors: 2017 Top Picks*, HAYDEN HARPER (Jan. 5, 2017), <https://www.haydenharper.com/best-robo-advisors-2017-top-picks/> [<https://perma.cc/297V-U8SE>].

193. See, e.g., Natt Garun, *Zelle, a Payment Network Backed by Major US Banks, Is Launching a Standalone App*, VERGE (Sept. 8, 2017, 8:00 AM), <https://www.theverge.com/2017/9/8/16270238/zelle-app-payment-service-us-banks-venmo-competitor> [<https://perma.cc/3VR4-ERTS>].

194. See, e.g., *Supercharger FinTech Accelerator 2.0 Reaches Final Milestone*, STANDARD CHARTERED (Apr. 18, 2017), <https://www.sc.com/en/media/press-release/supercharger-fintech-accelerator-2-0-reaches-final-milestone/> [<https://perma.cc/YX3L-739A>].

195. See, e.g., WORLD ECON. FORUM, *supra* note 19, at 17.

Although these changes can present welcome enhancement to the delivery of financial services, they also raise a number of important technological challenges. No challenge is perhaps more critical than that of interoperability. Not only must data be culled, but it must also be formatted in ways that other operators can read and use. For example, an app to facilitate P2P lending will need to integrate into a lender's data storage and analysis system as well as connect with firms that may be involved in collecting and processing borrower data (for example, credit bureaus such as Equifax or Transunion). Even virtual currencies will have to operate on interoperable platforms to achieve the highest levels of utility. Without credible interoperability, longer and more fragmented supply chains can comprise weak links. The failure of one or the other of these links can cause disruption to the multiple actors involved in delivering fintech services and products.¹⁹⁶

In turn, these changes pose difficulties for regulators. To begin with, disintermediation introduces structural changes to existing mechanisms that underlie the delivery of important financial services such as lending or payments. These changes can offer benefits, such as when platforms cheaply link borrowers with lenders or more user-friendly payment systems. But they also present risks. Smaller firms may lack experience as well as resources in financial markets. Interoperability can demand extensive technological know-how and failure is to be expected. When firms and technologies are new, understanding the consequences and costs of such failure creates resource demands on regulators to acquire the information needed to explain future risks and to support the financial system in case of fallout.

D. HOW FINTECH EXACERBATES THE TRILEMMA

Big data, artificial intelligence, and disintermediation are more than just the signifiers of modern day fintech. They also exacerbate the historical trade-offs presented by the trilemma. In this section we show that the defining features of fintech create an even more complex trilemma than historically present in financial regulation. At its most fundamental level, fintech creates informational gaps and uncertainties that increase the difficulty of evaluating the impact of emerging technologies on market integrity and investor protection. These challenges are more pronounced because of the extensive use in fintech of sophisticated algorithms and algorithmic trading. With pervasive informational uncertainties, achieving clear rules becomes problematic, particularly as the actors populating the financial markets grow more varied from those that have traditionally undergirded markets.

The three key features of fintech combine to create novel risks to market integrity: the potential for damage is uniquely difficult to measure. To start, the design

196. See Christine Jozet, *ISO TC68/AG2 Standards Advisory Group*, EUROPEAN BANKING AUTH., https://eba.europa.eu/regulation-and-policy/other-topics/approach-to-financial-technology-fintech-?p_p_auth=008sTOoH&p_p_id=169&p_p_lifecycle=0&p_p_state=maximized&p_p_col_id=column-2&p_p_col_pos=1&p_p_col_count=2&_169_struts_action=%2Fdynamic_data_list_display%2Fview_record&_169_recordId=2010553 [https://perma.cc/SPF8-F3G8] (last visited Dec. 10, 2018).

of fintech products and services—although anchored by vast troves of big and brand new types of data—introduces steep informational uncertainties for regulators.

For financial firms data drives investment, trading, hedging, and lending decisions.¹⁹⁷ Its promise to fuel creative innovations in product design (for example, in online lending) is showcased by fintech harnessing data from an expanding array of sources, sometimes of recent vintage. News and opinion websites, cell-phone data, social media, shopping preferences, and personal habits constitute fodder for fintech firms often looking to apply proprietary mining methodologies to extract insights.¹⁹⁸ Data, in short, is more ubiquitous, novel, and plentiful than ever before.¹⁹⁹

But big data also raises serious questions. Few such questions are more important—or complex—than whether newly available data is trustworthy. “Fake news” spread through doctored Facebook and Twitter profiles can impact the allocation of capital.²⁰⁰ And these social media outlets are difficult to supervise.²⁰¹ Systems available to test their usefulness for finance are in their infancy and can exhibit poor performance.²⁰² Data scraped from the Internet—originating from a multiplicity of decentralized sources (such as social media websites)—may be inaccurate, outdated or manipulated.²⁰³

AI and machine learning exacerbate these risks. Poor inputs result in poor outputs. And when it does, bad data acted upon by automated algorithms can introduce a new kind of model risk into financial markets—the risk that programming

197. The value of data reaches beyond fintech. *See, e.g., The World's Most Valuable Resource is No Longer Oil, but Data*, (May 6, 2017), <https://www.economist.com/leaders/2017/05/06/the-worlds-most-valuable-resource-is-no-longer-oil-but-data> [<https://perma.cc/8V5T-XSXX>].

198. *See, e.g., Allen Taylor, Peer-to-Peer Loans: Can Economically Intuitive Factors Improve Ability of Proprietary Algorithms to Predict Defaults?*, LENDING TIMES (July 17, 2017), <https://lending-times.com/2017/07/17/peer-to-peer-loans-can-economically-intuitive-factors-improve-ability-of-proprietary-algorithms-to-predict-defaults/> [<https://perma.cc/5JHS-UCGG>].

199. *See HE ET AL.*, *supra* note 19, at 7, 10.

200. *See supra* notes 150, 179 and accompanying text.

201. *See Chengcheng Shao et al., The Spread of Low-Credibility Content by Social Bots*, 9 NATURE COMM. 1 (2018); *see, e.g., Nicholas Carlson, The Real History of Twitter*, BUS. INSIDER (Apr. 13, 2011, 1:30 PM), <https://www.businessinsider.com/how-twitter-was-founded-2011-4> [<https://perma.cc/M452-SXZL>]; *Company Info*, FACEBOOK, <https://newsroom.fb.com/company-info/> [<https://perma.cc/3T3E-P3LL>] (last visited Oct. 30, 2018).

202. *See DELOITTE CTR. FOR FIN. SERVS.*, *supra* note 132, at 5; *see, e.g., Mannix & Smolinski, supra* note 136. Testing can involve subjecting technologies to simulated scenarios to see how they might perform, for example, during “normal” times as well as during crises. Tests may also evaluate how effectively a technology has weathered historical challenges. Tests might check to see the successful interoperability of the technology with those of different firms and financial services. Firms might wish to see the kinds of speeds and data-processing capacities that their technologies can achieve. Fintech testing may face difficulty owing to the newness of the technologies and their limited operating history. If a brand new technology has only been in existence for a couple of years, there may be insufficient history to know how effective a technology is under different market conditions as well as anticipate its performance under simulated conditions. *See Lane, supra* note 146.

203. *See Merle, supra* note 178.

does not accurately represent the world as it is.²⁰⁴ Algorithms operate in accordance with programming that is based on a set of assumptions, parameters, statistical models, and decisionmaking processes—any of which may be wrong, inaccurate, or imprecise.

Although model risk has always existed in markets to varying degrees, fintech's challenges become all the greater in the context of complex artificial intelligence. As discussed above, machine-learning algorithms are purposefully designed to reprogram themselves over time to reflect incoming data and external validation—with varying degrees of hands-on human supervision.²⁰⁵ This endogenous, computerized learning sets up the prospect that algorithms use internal processing and validation mechanisms whose reasoning and outputs are unpredictable *ex ante* and difficult to correct in real time, representing a kind of “black box” for regulators.²⁰⁶ Further, algorithms are capable of deploying speeds and data that surpass the cognitive capacities of human beings. A more fragmented fintech supply chain means that programming must be interoperable across a greater number of actors, increasing the points of vulnerability at which something can go awry.

Critically, although big data can help algorithms process volumes of information and ensure that programming is more responsive, it also requires that this programming be powerful enough to capture, interpret, and assign a value to this content. This task can be challenging, even for cutting-edge automated systems. For example, algorithms may only be able to produce interpretations that rest on the assumption that human beings function rationally or within certain defined parameters of behavior. Actions that reflect biases or idiosyncratic motivations can often be difficult for algorithms to process.²⁰⁷ In lending, for example, scholars have highlighted the role of human biases and behavioral quirks in shaping borrowing and repayment behavior.²⁰⁸ Although algorithms may be growing more sophisticated and perhaps capable of accounting for certain heuristics, those

204. See Yesha Yadav, *How Algorithmic Trading Undermines Efficiency in Capital Markets*, 68 VAND. L. REV. 1607, 1647–55 (2015).

205. See *supra* notes 161–63 and accompanying text.

206. See PASQUALE, *supra* note 135, at 59–65 (discussing secretive search algorithms used by well-recognized search engine Google as well as other portals such as Apple and Amazon that influence “what we do, think and buy”); Will Knight, *The Dark Secret at the Heart of AI*, MIT TECH. REV. (Apr. 11, 2017), <https://www.technologyreview.com/s/604087/the-dark-secret-at-the-heart-of-ai/> [<https://perma.cc/D5B7-UBFF>]. But see Vijay Pande, *Artificial Intelligence's “Black Box” Is Nothing to Fear*, N.Y. TIMES (Jan. 25, 2018), <https://www.nytimes.com/2018/01/25/opinion/artificial-intelligence-black-box.html> [<https://nyti.ms/2GieLsu>].

207. See Conrad De Aenlle, *A.I. Has Arrived in Investing. Humans Are Still Dominating.*, N.Y. TIMES (Jan. 12, 2018), <https://www.nytimes.com/2018/01/12/business/ai-investing-humans-dominating.html> [<https://nyti.ms/2FtpsbF>].

208. See Benjamin J. Keys & Jialan Wang, *Minimum Payment and Debt Paydown in Consumer Credit Cards* 3 (Nat'l Bureau of Econ. Research, Working Paper No. 22742, 2016), <http://www.nber.org/papers/w22742.pdf>. There is a considerable and growing literature on behavioral aspects of lending. In the case of retirement and investment choices, see, for example, Brigitte C. Madrian & Dennis F. Shea, *The Power of Suggestion: Inertia in 401(k) Participation and Savings Behavior*, 116 Q.J. ECON. 1149 (2001).

whose programming cannot account for these more complex, softer variables are likely to deliver an imprecise or erroneous result.

Concerns about the robustness of algorithmic programming raises the distinct but related question regarding how well algorithms might perform under unusual, unpredictable, or stressful market conditions. What happens when real-world conditions fall outside of an algorithm's programming and when learning algorithms struggle to process softer data to derive predictions? In such cases, algorithmic programming can lack the necessary flexibility to react effectively to a shifting market environment and thus deliver inferior results as compared to human intermediaries.²⁰⁹ For example, research has highlighted that human beings may be able to cope much more effectively in difficult, complicated circumstances that require them to think on their feet and take unusual, creative steps.²¹⁰ Anecdotally, examples like that of Betterment noted in the Introduction, illustrate the enormous difficulty that programmers face in designing algorithms that can capture and respond to any number of unexpected, real-world scenarios.

All the while, the participation of small, sometimes inexperienced firms raises the danger that they may not possess the institutional resilience to withstand the fallout caused by their error or the collapse or similar failures of another firm within a more fragmented financial supply chain. The computational complexity of algorithmic programming and big data means that firms need deep pockets to invest in developing and overseeing the quality of data processing and algorithmic design. Yet small firms or those new to Wall Street are likely to lack the resources to do so. Importantly, interconnections between firms, rather than within departments of one single firm, may be more susceptible to the risk that one or more of these links fails and causes disruptions to the supply chain as a whole. To the extent that such vulnerabilities exist, firms must be able to collaborate to identify risks and work out how to reduce bad outcomes. But where such small firms operate as part of longer or more fragmented supply chains, any single firm within the supply chain will likely lack the incentive to police its functioning.

In response to such probable and potentially serious risks, conventional wisdom would suggest that regulators will turn to tried-and-tested mechanisms designed to impose checks and controls on firms. As discussed in Part I, in response to possible dangers, regulators have imposed a range of measures to offset the risk and to protect market integrity: mandatory disclosure rules requiring information about a firm's future activities; activity bans; entry restrictions on

209. See Vikas Raman et al., *Man vs. Machine: Liquidity Provision and Market Fragility 4* (2015) (unpublished manuscript), https://www.nseindia.com/research/content/1314_BS8.pdf; see also Bruno Biais et al., *Equilibrium Pricing and Trading Volume Under Preference Uncertainty*, 81 *REV. ECON. STUD.* 1401, 1402–03 (2014) (noting that algorithms struggle to overcome “preference uncertainty” when outside circumstances require nuance, flexibility, and the capacity to reevaluate trading strategies).

210. See Raman et al., *supra* note 209, at 4.

those seeking to offer financial services; conduct of business rules; or the requirement for capital buffers to ensure that firms suffering losses can afford them.²¹¹

Still, fintech's mix of new and old firms within a more fragmented and disintermediated financial supply chain complicates the task of memorializing an effective set of rules. More resources must be allocated to understanding a constantly evolving ecosystem and deploying rules expeditiously enough to core regulatory objectives. The fragmentation caused by disintermediation also makes the task of allocating regulatory burdens fairly within the financial sector more challenging. Smaller firms often pose greater risks, given their limited size and balance sheet. But compliance costs are relatively fixed and do not always scale proportionately. Small firms with good ideas might be driven out of the market where complex obligations and rules are imposed, undermining competition—and ultimately innovation—in the process. And overall, market integrity itself can be compromised where firms fail to comply due to the relative opaqueness of the governing regulatory system.

III. THE SPECTRUM OF REGULATORY RESPONSES

Regulators in the United States and around the world have adopted a diverse spectrum of approaches toward fintech, from relatively informal to relatively more formal measures. This Part outlines these regulatory strategies, details how they deal with the risks of fintech, and examines their effectiveness through the lens of the trilemma. We conclude with a discussion of a kind of experimental financial regulation in the form of “sandboxes.”

At first glance, regulators appear to have adopted distinct policy preferences in overseeing fintech, as evidenced by their choice of specific tools and supervisory mechanisms. Whereas some regulators seem to have enthusiastically embraced regulatory experimentation by offering sandboxes to innovators, others have sought to bring new technologies within the purview of existing regulation. In this Part, however, we suggest that the various strategies that regulators have put forward should not be conceptualized as distinct binary choices between high and low levels of regulation. Rather, we argue that policymakers are utilizing a range of approaches that enable varying forms of control, experimentation, and guidance. Moreover, how regulators choose to label certain regulatory approaches (for example, “sandboxes,” “charters,” or “licenses”) itself represents a form of strategic signaling that may not always accurately convey the degree of compliance intensity a regulator intends to impose. For example, offering a “charter” instead of a “sandbox” might hint that a regulator intends to impose a more exacting regulatory regime.²¹²

211. *See supra* Section I.A.

212. As we discuss below, a charter represents a method of formally authorizing a firm to conduct certain regulated activities. *See infra* Section III.C. Sandboxes reflect a more innovative approach to regulation, offering firms a space within which to experiment under circumscribed conditions. *See infra* Section III.D.

However, this need not always be the case. As fintech broadens the scope and application of existing regulatory tools, charters can also be used in a way that gives innovators room for regulatory experimentation. Conversely, although sandboxes might point to a willingness to tolerate risky experimentation by fintech firms, the design of the sandbox can impose strictures that force firms to internalize sizable compliance costs. This availability of multiple regulatory methods also gives regulators flexibility in tackling innovations at various stages of development. For example, sandboxes or more informal guidance may be helpful to assist brand new technologies. A sandbox can enable regulators to collect information about a novel product as a basis for deciding how best to regulate it in the future. In turn, informal tools such as guidance can offer innovators a roadmap as they develop new ideas. More formal methods such as charters, licenses, or legislation may be more suited to regulate more mature technologies whose risks and benefits are clearer.

In analyzing these varying approaches this Part breaks down the objectives behind evolving regulatory strategies and highlights where these strategies fall short in dealing with the new risks posed by fintech. Our discussion surveys a spectrum of regulatory responses: (i) informal guidance, including discrete actions, such as through no-action letters; (ii) pilots; (iii) licenses and charters; and (iv) sandboxes as examples of more experimental regulatory strategies. Our goal in this Part is to highlight the broad approaches being adopted by regulators to contend with fintech, rather than providing a granular survey of each kind of regulatory action being taken across international markets. This Part thus showcases the major trends and shortcomings in meeting the specific challenges posed by the use of big data, by AI, and by the disintermediation characteristic of today's fintech.

A. INFORMAL GUIDANCE

One avenue of mediating the trilemma is informality. Regulators can offer their views or expectations of market participants without necessarily undergoing a full administrative or procedural rulemaking. As such, their guidance does not necessarily obligate authorities to permanently condone or prohibit any particular course of action.²¹³ But informal methods can offer a means of facilitating innovation or building market integrity through direct and simple communication with market participants. By providing guidance or taking ad hoc actions such as giving speeches or issuing no-action letters, regulators can take steps to shore up market integrity by signaling areas of possible concern or future regulation.²¹⁴ Such regulatory action enables fintech firms to better innovate, insofar as they are able to better recognize what kind of regulatory burden they might face.

This kind of informal action may be undertaken on a case-by-case basis and thus implicitly acknowledges the evolving nature of innovation. It is also an

213. See *No Action Letters*, U.S. SEC. & EXCH. COMM'N (Mar. 23, 2017), <https://www.sec.gov/fast-answers/answersnoactionhtm.html> [<https://perma.cc/9X48-QHMG>].

214. See, e.g., Hinman, *supra* note 7.

approach with an established pedigree in the regulatory canon. U.S. securities regulators, for one, rely extensively on no-action letters.²¹⁵ With a no-action letter, the SEC can clarify its position to a market participant about whether it considers a proposed line of action to be in breach of securities rules or likely to elicit an enforcement action. Such letters offer specific market participants (and sometimes the industry at large) guidance on the future permissiveness of the SEC regarding a specific course of action.²¹⁶ General guidance also provides an idea of what kinds of behavior the SEC considers to be acceptable.²¹⁷

Unsurprisingly, regulators are issuing guidance about what kind of compliance obligations attach to innovations. Robo advising, for instance, represents an area whose development appears to have preceded the articulation of a coherent body of law to regulate its practice. The SEC has delivered guidance to explain how robo advising can comply with the body of law governing investment advising.²¹⁸ Although merely guidance rather than regulation, it explains the significance of key protections for investors, such as the requirement that advisors observe a fiduciary standard vis-à-vis those they advise.²¹⁹ The guidance describes the disclosure practices that firms might comply with when using robo advisors in their business; these practices include both general disclosures as well as those specific to robo advice (for example, telling clients that an algorithm is assisting in managing their money).²²⁰ In the area of ICOs, SEC leadership has given speeches as well as signaling statements outlining the prospective risks of ICOs, pointing to the chances of future regulation in this area.²²¹

This flexible regulatory approach can generate a number of benefits. For one, regulators deploy tools that are familiar and easily implemented. Guidance—from reports to no-action letters—can be delivered swiftly and are responsive to

215. See Donna M. Nagy, *Judicial Reliance on Regulatory Interpretations in SEC No-Action Letters: Current Problems and a Proposed Framework*, 83 CORNELL L. REV. 921, 921–22 (1998).

216. See *No Action Letters*, *supra* note 213 (detailing the different forms that such letters take and the scope of their permissiveness); see also Kimberly Till, *The SEC Safe Harbor for Forecasts—A Step in the Right Direction?*, 1980 DUKE L.J. 607 (describing the SEC safe harbor for future-looking forecasts and discussing the safe harbor mechanism); *Rule 506 of Regulation D*, U.S. SEC. & EXCH. COMM’N (Nov. 27, 2017), <https://www.sec.gov/fast-answers/answers-rule506htm.html> [<https://perma.cc/47DM-WW54>] (outlining a very popular safe harbor used to raise capital in the private market).

217. See, e.g., Div. INV. MGMT., U.S. SEC. & EXCH. COMM’N, GUIDANCE UPDATE (Feb. 2017), <https://www.sec.gov/investment/im-guidance-2017-02.pdf>; Clayton, *supra* note 1.

218. See, e.g., Div. INV. MGMT., *supra* note 217; Clayton, *supra* note 1.

219. See Div. INV. MGMT., *supra* note 217. Note, however, that FINRA raises concerns about the capacity of robo advisors to comply with the fiduciary standard. See Melanie L. Fein, FINRA’s Report on Robo-Advisors: Fiduciary Implications (May 7, 2016) (unpublished manuscript), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2768295 [<https://perma.cc/37NY-DLMQ>] (noting the concerns raised by the FINRA guidance about the likely compliance of robo advisors with the fiduciary standard). Also, note that the International Organization of Securities Commissions (IOSCO) has issued guidance on the regulation of robo advising in fintech. See INT’L ORG. OF SEC. COMM’S, UPDATE TO THE REPORT ON THE IOSCO AUTOMATED ADVICE TOOLS SURVEY: FINAL REPORT (2016), <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD552.pdf> (detailing the spectrum of approaches taken by national regulators with respect to the growth of robo advising in their domestic jurisdictions).

220. See Div. INV. MGMT., *supra* note 217, at 3–4.

221. See *supra* notes 1–7 and accompanying text.

fast-moving market developments. Compliance costs for firms may decrease as a result. Firms can use guidance to avoid falling foul of regulatory prohibitions and becoming subject to penalties and sanctions. All the while, informal guidance can help signal enforcement priorities and the regulatory intent to give wider berth to certain proposed activities.

That said, informal guidance does not necessarily increase the informational capital within agencies. Informal guidance does not ordinarily require notice and comment or data collection—or, for that matter, any iterative contact or information sharing with regulators during the course of the relevant conduct.²²² It thus provides only a limited channel for bolstering regulatory expertise. Instead, data is largely generated once permission has been granted, in a post hoc manner. Decisions may, as a result, introduce undue risk or alternatively prove too restrictive. Only when a new process is generated, by new no-action requests or internal studies may guidelines be revisited. Meanwhile, from the standpoint of market participants, no-action letters offer relief only to the firm making a request, and even then only indicate that the SEC staff would not recommend that the SEC take enforcement action against the requesting firm based on the facts and representations described in the individual's or entity's request. No guarantees are made.

B. PILOTS

One way to address some of the limitations of informal guidance is through experimentation. In practice, experimentation often takes place in the form of pilots, through which regulators can design or oversee tests involving new innovations or techniques, observe outcomes, and then tailor rulemaking to its most efficient and effective form. These tests offer a means to facilitate financial innovation as well as safeguard market integrity. Properly designed, pilots provide regulators with a way to generate information on the likely effects of particular products or services. Such data can be useful for policymakers to observe risks, the chances that risks spread, networks, and the capacity of market firms to bear the costs of innovations.²²³ Equipped with closer real-world knowledge, regulators are well placed to craft rules that facilitate desirable innovations in a way that protects market safety and soundness.

As with informal guidance, pilots can take a number of shapes and approaches. In China, where pilots are common, authorities have introduced a range of regulatory pilot projects tied to liberalizing the country's financial markets and

222. See OFFICE OF THE FED. REGISTER, A GUIDE TO THE RULEMAKING PROCESS (2011) https://www.federalregister.gov/uploads/2011/01/the_rulemaking_process.pdf (“Guidance documents do not contain amendments to the CFR and are not subject to the notice and comment process.”). In other words, guidance is unlikely to require regulated entities to provide information to the regulator on their conduct or future activity. Rather, such guidance constitutes communication from the regulator to the market, rather than tasking the market participants to provide detailed data on their activities to the regulator.

223. See Brett Redfearn, Dir., Div. of Trading & Mkts., Remarks at the Equity Market Structure Symposium Sponsored by the University of Chicago and the STA Foundation (Apr. 10, 2018), <https://www.sec.gov/news/speech/speech-redfearn-2018-04-10> [<https://perma.cc/R4DG-C9KT>].

improving financial access. For example, the China Insurance Regulatory Commission (CIRC), the country's insurance regulator, introduced a two-year pilot project designed to give insurance companies the regulatory room to offer services and products across city and state lines. Starting on February 1, 2017, the CIRC began allowing insurance companies based in Beijing, Tianjin, or Hebei to conduct business across these regions.²²⁴ The avowed objective of the pilot is to encourage insurance companies to set up shop in Tianjin or Hebei, where costs are lower relative to Beijing, and to sell their services in Beijing and elsewhere within the permitted zone.²²⁵ Companies participating in the pilot must meet eligibility conditions, but otherwise, the pilot offers an illustration of regulators seeking to test run regulatory innovations within a controlled setting.²²⁶ In addition to insurance, Chinese regulators are also running pilots in the areas of banking,²²⁷ wealth fund management,²²⁸ and tax.²²⁹

Pilot programs in the United States, by contrast, are rarer and structured to resemble natural experiments—often supported by strict rules and conditions aimed at ensuring the collection and analysis of data. For example, in October 2016, the SEC began its two-year pilot program to experiment with “tick sizes,” or the price increments in which the buying and selling price of stocks is quoted on national exchanges.²³⁰ The SEC's study examines tick sizes for “small-cap” stocks—those with a market capitalization of three billion dollars or less.²³¹ Instead of applying new tick sizes to small-caps across the board, the pilot format targets an expressly empirical approach to regulation. A total of 1,400 small-cap stocks are divided into control and test groups.²³² The control group uses the current tick size of one cent per share (for example, \$1.01) while the test groups use five-cent minimum increments (for example, \$1.05), which are also divided in

224. See *China: Pilot Programme for Insurance Company and Agency Cross-Regional Business*, LLOYD'S (Feb. 21, 2017), <https://www.lloyds.com/the-market/communications/regulatory-communications-homepage/regulatory-communications/regulatory-news-articles/2017/03/china-pilot-programme-for-insurance-company-and-agency-crossregional-business> [https://perma.cc/VF4W-VGJV].

225. See *id.*

226. See *id.*

227. See, e.g., *China to Launch Private Bank Pilot Program*, REUTERS (Mar. 10, 2014, 9:35 PM), <http://www.reuters.com/article/us-china-economy-banks-idUSBREA2A02V20140311> [https://perma.cc/7EDZ-4VTY].

228. Gabriel Wildau & Shengnan Zhang, *China Pilot Scheme Aims to Shatter Assumption; Investments are Not Guaranteed*, REUTERS (Oct. 10, 2013), <https://www.reuters.com/article/us-china-banks-debt-idUSBRE99915D20131010> [https://perma.cc/KFM3-ACL6].

229. See, e.g., Xingxing Zhang, *China Launches VAT Pilot Program in Special Customs Supervision Zone*, IT CONVERGENCE (Mar. 30, 2017), <http://www.itconvergenceinsights.com/china-launches-vat-pilot-program-in-special-customs-supervision-zones> [https://perma.cc/R2RZ-TFRE].

230. See *Investor Alert: Tick Size Pilot Program—What Investors Need to Know*, U.S. SEC. & EXCH. COMM'N (Oct. 3, 2016), https://www.sec.gov/oiea/investor-alerts-bulletins/ia_ticksize.html [https://perma.cc/GY72-GV4U].

231. *Id.* In addition to market capitalization, for example, the study also requires the selected companies to be subject to trading volume limitations (for example, seeing fewer than average daily trading volume of one million shares or less and a volume-weighted average price of at least \$2.00 for every trading day). *Id.*

232. *Id.*

accordance with certain other controlled conditions.²³³ Through this study, the SEC should garner concrete insights into whether changes to tick sizes for small-cap stocks are likely to impact how efficiently these stocks trade. Ultimately, by testing out which trading conditions are most beneficial, regulatory policy and decisionmaking can be better informed.²³⁴

Similarly, the CFPB has encouraged fintech innovators to pitch proposals for pilot programs or novel disclosure trials to meet its goals of enhanced consumer protection. Launched in 2012, the Project Catalyst program encourages entrepreneurs to offer ideas for pilot projects to the Bureau's staff. When the staff finds "strong, testable potential for substantive benefit to everyday people," experimental programs may be made available for testing.²³⁵ For example, H&R Block, the tax advisory and preparation firm, introduced a program designed to study the effectiveness of certain tax planning and saving practices.²³⁶ The program included practices such as providing consumers with better informational materials to encourage them to save a portion of their tax refund, as well as greater disclosure of savings products when they make their tax preparation appointment.²³⁷ Project Catalyst has featured a range of pilots covering experimental initiatives to test innovations in credit provision, disclosure, and tax planning.²³⁸

Pilot programs operate further along the regulatory frontier than informal guidance mechanisms. They allow for more experimentation and innovation (as well as risk taking) than ad hoc, case-by-case no-action letters. They also create more legal certainty than informal guidance regimes during the period in which they are in effect, even as the rules applied to conduct may be stricter to ensure that an experiment may be conducted and data gathered for analysis. Notably, however, the pilot does not offer any certainty about whether the conduct under observation will eventually be permitted or how broadly this activity might be rolled out in the market. In the case of China, for instance, where pilots appear to be a heavily used regulatory tool, there may be greater expectation that results lead to permanent activities that are more broadly extended to other parts of the country. By

233. *Id.*

234. The SEC's study is being undertaken under the Jumpstart Our Business Startups Act, Pub. L. No. 112-106, 126 Stat. 306 (2012) (codified as amended in scattered sections of 15 U.S.C.), to see how decimalization of tick sizes might affect the ease by which investors and issuers in small-cap stocks trade by looking at the impact on liquidity and volatility of trading conditions. *See Investor Alert, supra* note 230. For discussion on the purposes of the study as well as more detail on its experimental methods, *see id.*

235. *See Let's Collaborate: Pitch a Pilot*, U.S. CONSUMER FIN. PROT. BUREAU, <https://www.consumerfinance.gov/about-us/project-catalyst/pitch-pilot/> [<https://perma.cc/9LMH-LN6P>].

236. *See* PROJECT CATALYST REPORT: PROMOTING CONSUMER-FRIENDLY INNOVATION, U.S. CONSUMER FIN. PROT. BUREAU 19 (2016), https://s3.amazonaws.com/files.consumerfinance.gov/files/documents/102016_cfpb_Project_Catalyst_Report.pdf.

237. *See id.* *But see* Brian V. Breheny et al., *SEC's Proposed Transaction Free Pilot Program Continues to Provoke Discussion*, SKADDEN (July 16, 2018), <https://www.skadden.com/insights/publications/2018/07/secs-proposed-transaction-fee-pilot-program> [<https://perma.cc/ZH2D-TB2K>].

238. *See id.* at 17–20; *see also Recent Updates*, U.S. CONSUMER FIN. PROT. BUREAU, <https://www.consumerfinance.gov/activity-log/?topics=project-catalyst> [<https://perma.cc/PSG2-TSNA>] (last visited Oct. 30, 2018).

contrast, in the United States, where pilots are rarer and may have less predictive power, pilots can at least offer an empirical basis on which to formulate discrete rules, even if such rules are not in themselves the subject of the experiment. Just like no-action letters, pilots can be ended after the test period, allowing for policy reversals.

C. LICENSES

In a less direct form of experimentation—but a more permanent form of limited permission granting—regulators can grant discrete licenses allowing relevant firms to engage in specified activities, though under highly controlled and restrained circumstances. Licenses and charters can be especially useful to regulators. Through their use, regulators can control who enters the market and carefully scrutinize entry to permit only those entities that can safely participate. Through this process, they can acquire information about firms, their products and services, and what kinds of risks they pose. Such information offers a way to enhance the effectiveness of rulemaking to govern innovations.

Licenses of this kind can be “rules based,” offering bright lines as to how they are granted, or they can be more discretionary. In other words, a rules-based license sets out exact conditions under which an activity may occur. By contrast, a more discretionary approach authorizes firms to conduct a range of activities of their choosing under an umbrella permission. An example of a more rules-based approach is the U.S. approach to equity crowdfunding. Under the Jumpstart Our Business Startups (JOBS) Act, the SEC issued rules permitting startups to issue equity securities to ordinary people through the Internet so long as they meet minimal specified disclosure requirements. As a means of controlling investor risk, the amount of money investors are permitted to invest is capped and an issuer is limited to raising a maximum of one million dollars.²³⁹

There are clear advantages to using bright-line legislation to license innovations in fintech. With rules laid out in advance offering permanent regulatory relief, there is minimal legal uncertainty. Furthermore, the rules are clear and simple, allowing for easy compliance. This clarity can encourage firms and investors

239. Jumpstart Our Business Startups Act, Pub. L. No. 112-106, § 302, 126 Stat. 306, 315 (2012); Crowdfunding, 80 Fed. Reg. 71388 (Nov. 16, 2015) (to be codified at 17 C.F.R. pt. 200). Regulation Crowdfunding took effect in May 2016 to allow small companies to raise around one million dollars in a year through designated portals that display their offering documents as well as offer investors a means to certify wealth and eligibility to participate in the offering.

On disintermediation, see generally C. Steven Bradford, *Crowdfunding and the Federal Securities Laws*, 2012 COLUM. BUS. L. REV. 1 (showcasing the history of crowdfunding and a proposal for legislation); Brummer, *supra* note 187, at 1020–35 (discussing the disintermediation of public companies); Andrew A. Schwartz, *Crowdfunding Securities*, 88 NOTRE DAME L. REV. 1457 (2013). In addition to Regulation Crowdfunding, the SEC has also passed Regulation A+ (with an offering amount of up to fifty million dollars) to facilitate capital raising. See Amendments for Small and Additional Issues Exemption Under the Securities Act (Regulation A), 80 Fed. Reg. 21,806 (Apr. 20, 2015); David Gilinsky et al., *Regulation of Crowdfunding in the UK, US and Israel: A Comparative Review*, 10 J. INT'L BANKING & FIN. L. 600A (2016) (discussing the requirements of Regulation A+).

to come forward. It can also help ensure that regulators are engaged in supervision and are enforcing the terms and conditions of their participation.

But there are also disadvantages. As with any bright-line approach, the rules can be over- and under-inclusive. Some individuals may be sophisticated enough to make larger investments despite their net worth but restricted in their abilities to take on this risk. Moreover, caps placed on the total amount of money a firm may raise can stifle fundraising altogether or create a two-speed marketplace. As Professor Usha Rodrigues writes, real money-making companies are unlikely to reach out to the common man for an investment, particularly one capped at one million dollars.²⁴⁰ This reality then can leave only lemons for small-time investors to pick through as top-flight ventures are marketed privately to rich, professional investors.²⁴¹ From this standpoint, the license—though limited—does not necessarily solve or mitigate the challenges inherent to the trilemma.

Not surprisingly, some regulators have preferred to maintain discretion in their attempts to introduce greater (and safer) innovation. For example, in an effort to soften the hard strictures of banking regulation for fintech, the OCC has introduced “fintech charters” that permit firms to acquire the designation of a special purpose national banking organization.²⁴² As initially proposed, by complying with specific eligibility criteria modified from those the OCC applies to

240. Usha Rodrigues, *Securities Law's Dirty Little Secret*, 81 *FORDHAM L. REV.* 3389, 3427–37 (2013).

241. *See id.* On the changing notion of “publicness” in securities markets in response to deregulation and technological changes, see Donald C. Langevoort & Robert B. Thompson, “Publicness” in *Contemporary Securities Regulation After the JOBS Act*, 101 *GEO. L.J.* 337 (2013); *see also* Brummer, *supra* note 187.

242. *See* U.S. OFFICE OF THE COMPTROLLER OF THE CURRENCY, EXPLORING SPECIAL PURPOSE NATIONAL BANK CHARTERS FOR FINTECH COMPANIES (2016), <https://www.occ.gov/topics/responsible-innovation/comments/special-purpose-national-bank-charters-for-fintech.pdf> [hereinafter OCC, EXPLORING SPECIAL PURPOSE]; *see also* Perianne Boring, *You Down with OCC?—FinTech Firms See Promise in Special Bank Charter*, *FORBES* (Jan. 27, 2017, 8:09 AM), <https://www.forbes.com/sites/perianneboring/2017/01/27/you-down-with-occ-fintech-firms-see-promise-in-special-bank-charter/#4322d7d032e1> [<https://perma.cc/4HZT-DHB6>]. The OCC released additional policy guidance and began accepting national bank charter applications in 2018. *See* U.S. OFFICE OF THE COMPTROLLER OF THE CURRENCY, POLICY STATEMENT ON FINANCIAL TECHNOLOGY COMPANIES’ ELIGIBILITY TO APPLY FOR NATIONAL BANK CHARTERS (2018), <https://www.occ.treas.gov/publications/publications-by-type/other-publications-reports/pub-other-occ-policy-statement-fintech.pdf>; Press Release, U.S. Office of the Comptroller of the Currency, OCC Begins Accepting National Bank Charter Applications from Financial Technology Companies (July 31, 2018), <https://www.occ.gov/news-issuances/news-releases/2018/nr-occ-2018-74.html> [<https://perma.cc/5RQ8-5MXY>] [hereinafter Press Release, OCC]; *see also* U.S. OFFICE OF THE COMPTROLLER OF THE CURRENCY, COMPTROLLER’S LICENSING MANUAL SUPPLEMENT: CONSIDERING CHARTER APPLICATIONS FROM FINANCIAL TECHNOLOGY COMPANIES (2018), <https://www.occ.gov/publications/publications-by-type/licensing-manuals/file-pub-lm-considering-charter-applications-fintech.pdf>.

The OCC established an Office of Innovation designed to forward fintech and other initiatives. In addition, some have criticized the proposal as potentially falling short on the goal of putting fintech to use in broadening financial inclusion. *See, e.g.,* MELANIE BRODY & JEFFREY TAFT, MAYER BROWN, SPECIAL-PURPOSE NATIONAL BANK CHARTERS FOR FINTECH COMPANIES (2017), <https://www.mayerbrown.com/files/Event/f6832c7e-5ce0-4c95-9915-450f79988543/Presentation/EventAttachment/7d9ad646-f7b3-49b8-ace6-bf89fb000142/170118-NYC-SEMINAR-CFS-Breakfast-Briefing-Slides.pdf>.

traditional banks, fintech firms can win a charter to perform certain banking-related activities.²⁴³ Holding an OCC charter means fintech firms can avoid the costs and complexities of complying with various state laws, and instead follow the rules of the OCC's federal regime.²⁴⁴

The program has been celebrated by some industry experts but has also attracted criticism, even among bankers and lobbyists. Among the chief complaints is that the OCC, although announcing standards for charters, explicitly refrains from articulating how, in practice, it “will evaluate, supervise, and examine” applicants, undermining the clarity and potential simplicity of the program.²⁴⁵ Under the proposal, then, participants face uncertainty as to whether their efforts to obtain a charter will be welcomed by regulators or likely to attain success.²⁴⁶ Second, and closely related, the agency's case-by-case approach does not, as of yet, clearly provide *ex ante* indications as to how much latitude it will give fintech firms to operate in more traditional banking sectors. Instead, the agency instructs firms that they will need to demonstrate how their policies, procedures, and practices will protect individuals and small business customers—without firms knowing exactly how to meet these expectations or what specific advantages the OCC will grant via the charter.²⁴⁷ Collectively, these problems have made the program, in the eyes of some firms, too risky to commit their

243. See U.S. OFFICE OF THE COMPTROLLER OF THE CURRENCY, COMPTROLLER'S LICENSING MANUAL DRAFT SUPPLEMENT: EVALUATING CHARTER APPLICATIONS FROM FINANCIAL TECHNOLOGY COMPANIES (2017), <https://www.occ.gov/publications/publications-by-type/licensing-manuals/file-pub-lm-fintech-licensing-manual-supplement.pdf>; see also OCC, EXPLORING SPECIAL PURPOSE, *supra* note 242, at 3–15.

244. This proposal has been controversial. Notably, state banking authorities sued the OCC in relation to its proposed issue of a national fintech banking charter, arguing that the OCC overstepped its authority and encroached upon the jurisdictions of state banking regulators. See Lalita Clozel, *State Regulators Sue OCC Over FinTech Charter*, AM. BANKER (Apr. 26, 2017, 10:00 AM), <https://www.americanbanker.com/news/state-regulators-sue-occ-over-fintech-charter> [https://perma.cc/5HWQ-NRPB]. This suit was dropped because no charter has yet been granted to fintech firms. In late fall, the states renewed their suit. See Lalita Clozel, *'Fintech Charter' Has No Early Takers as Lawsuit Looms*, WALL ST. J. (Sept. 12, 2018 11:00 AM), <https://www.wsj.com/articles/fintech-charter-has-no-early-takers-as-lawsuit-looms-1536764426> [https://perma.cc/AWP4-6KWV]; Neil Haggerty, *With OCC Wavering on Fintech Charter, Judge Drops States' Lawsuit*, AM. BANKER (May 1, 2018, 1:47 PM), <https://www.americanbanker.com/news/with-occ-wavering-on-fintech-charter-judge-drops-states-lawsuit> [https://perma.cc/PJM5-YPQW].

245. Letter from The Clearing House, Indep. Cmty. Bankers of Am., and Sec Indus. & Fin. Mkts. Ass'n., to the Office of the Comptroller of the Currency on Exploring Special Purpose National Bank Charters for Fintech Companies (Jan. 17, 2017), https://www.sifma.org/wp-content/uploads/2017/05/Joint_Trades_OCC_FinTech_Charter_Comment_Letter_vF.pdf; see also KEVIN PETRASIC ET AL., WHITE & CASE, *FINTECH COMPANIES AND BANK CHARTERS: OPTIONS AND CONSIDERATIONS FOR 2018*, at 5 (2018), <https://www.whitecase.com/sites/whitecase/files/files/download/publications/fintech-companies-and-bank-charters-options-and-considerations-for-2018.pdf> (“[T]he OCC has indicated that fintech national banks will have obligations under or similar to the Community Reinvestment Act, such as financial inclusiveness requirements, but has not specified how such requirements would be imposed or how evaluations would be conducted for fintech banks without physical locations”).

246. See Clozel, *supra* note 244.

247. See Press Release, OCC, *supra* note 242 (noting criteria, including that “[e]very application will be evaluated on its unique facts and circumstances”).

resources. Indeed, because of the controversies surrounding the program, the OCC has faced considerable pressure to rescind it or revise its parameters.²⁴⁸

D. REGULATORY “SANDBOXES”

Informal guidance, pilot studies, licenses, and charters grapple with financial innovation in various ways. These approaches seek to lower risk, improve the utility of innovations, and introduce system-wide clarity. Each of these tactics comes with its own set of trade-offs, as the trilemma predicts. Novel transactions may receive only tentative case-by-case (and informal) approval. Pilots may be attractive when information cost is low and the risks tied to commitment-making are high. Licenses, meanwhile, may seem appropriate when their constraints either appear easy to administer or are subject to ongoing discretionary control.

However, these are all ad hoc policy responses. Because these strategies operate incrementally, some regulators are combining them into more forward-looking forms of regulatory engagement. Commonly referred to as regulatory “sandboxes,” these programs represent an attempt by authorities to build supervisory capacity through engagement and state-sponsored innovation and experimentation. In some instances, sandboxes may be offered as part of a larger regulatory “Innovation Hub,” designed to offer firms assistance with navigating compliance burdens and testing their ideas against specific real-world problems.²⁴⁹

The sandbox arguably provides a genuinely new addition to the regulatory arsenal, different from past practices on which policymakers have relied to accommodate financial innovation.

The sandbox rests on two basic ideas: (i) innovators are provided an environment within which to experiment and try out their innovations under real-world conditions; and (ii) to do so, regulators offer developers a relaxed regulatory environment, albeit one subject to specific supervisory parameters and subject to continuing supervision.²⁵⁰ Sandboxes expressly seek to encourage innovation. They offer regulators a means to acquire insight into the development process for innovations, give input into their design, and better understand how emerging products and services might operate in the real world. Particularly for early-stage innovations, sandboxes can be helpful in reducing the pervasive information

248. See Haggerty, *supra* note 244.

249. See, e.g., *Innovate and Innovation Hub*, U.K. FIN. CONDUCT AUTH. (Sept. 20, 2018), <https://www.fca.org.uk/firms/innovate-innovation-hub> [<https://perma.cc/Z9WL-9MTT>]; *RegTech*, U.K. FIN. CONDUCT AUTH. (OCT. 4, 2018), <https://www.fca.org.uk/firms/innovate-innovation-hub/regtech> [<https://perma.cc/HW2U-DF7E>]; see also *FCA Innovate*, U.K. FIN. CONDUCT AUTH., <https://www.fca.org.uk/firms/fca-innovate> [<https://perma.cc/M2VW-F4YH>] (last visited Oct. 31, 2018) (demonstrating that the sandbox is part of a larger innovation lab). On sandboxes and their workability in the U.S. regulatory structure, see generally Hilary J. Allen, A US Regulatory Sandbox? (Feb. 8, 2018) (unpublished manuscript), <https://ssrn.com/abstract=3056993> [<https://perma.cc/M334-4SF8>].

250. See *Innovate and Innovation Hub*, *supra* note 249; see also AUSTL. SEC. & INV. COMM’N, LICENSING EXEMPTION FOR FINTECH TESTING, <http://asic.gov.au/for-business/your-business/innovation-hub/licensing-and-regulation/licensing-exemption-for-fintech-testing/> [<https://perma.cc/GU9M-ULHG>] (last visited Nov. 1, 2018).

uncertainties attaching to the growth of algorithms and AI, as well as to the viability of new data.

Although sandboxes come in different guises, with agencies and jurisdictions varying in what terms they offer, the guiding idea is simple enough: rather than be subject to restrictive or complex rules that elevate regulatory risk and potentially stifle innovation, the sandbox offers a means of testing new ideas in a simplified, interactive regulatory environment. And rather than deal with the usual silos operating in financial regulation—separating securities regulation from banking, for example—developers can build cross-sectoral inventions within the controlling parameters of the regulatory sandbox. A firm developing a digital wallet for customer payments, for instance, might wish to sell this technology to banks, credit card companies, investment funds, or insurance companies.

Regulatory sandboxes are increasingly popular and appear across jurisdictions. In the United Kingdom, the Financial Conduct Authority (FCA), a sandbox pioneer, has created an “Innovation Hub” whose purpose lies in testing financial products in a live environment. Rather than obtaining formal authorization, fintech firms can apply to be included in small cohorts that are selected to join a financial services incubator for developing and testing these new products.²⁵¹ The FCA offers these firms a restricted license.²⁵² Interestingly, firms that are already regulated by the FCA can also apply to use the sandbox.²⁵³ To help them test their ideas, the FCA is prepared to offer no-action letters with respect to enforcement, rule modifications, or license waivers as a means to encourage experimentation.²⁵⁴ The FCA is explicit in being open to softening or waiving the application of rules when they are likely to prove overly burdensome for would-be inventors.²⁵⁵

Other jurisdictions are competing to offer similar innovation hubs, albeit with some differences. As part of its sandbox, the Australian Securities and Investments Commission (ASIC), the Australian services market regulator, offers a broad, twelve-month licensing waiver to fintech companies to test out financial services and credit-based innovations in a real-world setting.²⁵⁶ This waiver means that firms are not required to obtain full authorization to conduct a regulated activity and can instead test out new innovations within the sandbox’s strategically relaxed compliance environment. There are conditions attached.

251. See U.K. FIN. CONDUCT AUTH., REGULATORY SANDBOXES LESSONS LEARNED REPORT (2017), <https://www.fca.org.uk/publication/research-and-data/regulatory-sandbox-lessons-learned-report.pdf>; *Regulatory Sandbox*, U.K. FIN. CONDUCT AUTH. (Oct. 22, 2018), <https://www.fca.org.uk/firms/innovate-innovation-hub/regulatory-sandbox> [<https://perma.cc/7VZR-WPEB>].

252. See U.K. FIN. CONDUCT AUTH., *supra* note 251, at 9 (“Restrictions are placed on each firm’s authorisation to ensure that they are only able to test up to the volumes prescribed in their testing plans.”).

253. See *Applying to the Regulatory Sandbox*, U.K. FIN. CONDUCT AUTH. (Oct. 15, 2018), <https://www.fca.org.uk/firms/regulatory-sandbox/prepare-application> [<https://perma.cc/J95K-PYMZ>].

254. See *Sandbox Tools*, U.K. FIN. CONDUCT AUTH. (Dec. 15, 2017), <https://www.fca.org.uk/firms/regulatory-sandbox/sandbox-tools> [<https://perma.cc/K9TK-TY9F>].

255. See *id.*

256. See AUSTL. SEC. & INV. COMM’N, *supra* note 250.

Aspiring firms cannot have more than 100 (upper limit, 200) retail clients, though an unlimited number of nonretail clients are permitted.²⁵⁷ They must also comply with stipulated disclosure and other stated obligations and maintain adequate ability to compensate investors for losses.²⁵⁸ Still, the license waiver is promoted as a way to test fintech products and thus to eventually ease the future path to regulation for fintech companies.²⁵⁹

In Canada, the Ontario Securities Commission (OSC) supports fintech innovation through its LaunchPad. The LaunchPad aspires to offer a way for fintech firms to engage with the regulator to navigate an uncertain regulatory environment in bringing new products to the market.²⁶⁰ The OSC's program appears to focus more on helping fintech firms enter a regulated space, rather than waiving or relaxing regulations to create a space within which innovators may try out ideas. Still, the OSC, too, has offered some regulatory accommodation to enable services and products to be tested. For example, the OSC has granted time-limited relief from regulatory requirements for a variety of firms, subject to them complying with certain conditions.²⁶¹

Another interesting model is seen in the case of Hong Kong, whose sandbox is open to banking firms that are already authorized by the Hong Kong Monetary Authority.²⁶² Firms that are not authorized—like nontraditional tech startups—

257. AUSTL. SEC. & INV. COMM'N, REGULATORY GUIDE 257: TESTING FINTECH PRODUCTS AND SERVICES WITHOUT HOLDING AN AFS OR CREDIT LICENCE 32 (2017), <https://download.asic.gov.au/media/4420907/rg257-published-23-august-2017.pdf>; see Michael Vrisakis et al., *World-First Licensing Exemption for Fintech Businesses—ASIC's New Regulatory Sandbox*, HERBERT SMITH FREEHILLS (Dec. 20, 2017), <https://www.herbertsmithfreehills.com/latest-thinking/world-first-licensing-exemption-for-fintech-businesses-%E2%80%93-asic%E2%80%99s-new-regulatory> [<https://perma.cc/GLF7-F9WH>].

258. See AUSTL. SEC. & INV. COMM'N, *supra* note 257, at 27.

259. See AUSTL. SEC. & INV. COMM'N, *supra* note 250; Vrisakis et al., *supra* note 257.

260. See *LaunchPad*, ONT. SEC. COMM'N, <https://www.osc.gov.on.ca/en/osclaunchpad.htm> [<https://perma.cc/6M6N-M5SW>] (last visited Dec. 10, 2018). For example, a Canadian P2P lender, the Lending Loop, was considered to be offering “securities” under the applicable securities regulation regime because it was offering its services to a wide range of consumers and businesses. By selling securities, Lending Loop would have needed to undergo a costly authorization process. The OSC offered Lending Loop authorization through direct engagement with the company, eventually making it a fully authorized P2P lending platform. See Allan Goodman, *Three Major Developments in the Regulation of Canadian FinTech Companies*, GOODMANS (Oct. 25, 2016), http://www.goodmans.ca/Doc/Three_Major_Developments_in_the_Regulation_of_Canadian_FinTech_Companies [<https://perma.cc/FMH2-GQTN>].

261. See *Navigating Securities Regulation*, ONT. SEC. COMM'N, <http://www.osc.gov.on.ca/en/navigating-regulation.htm> [<https://perma.cc/HE89-TWAU>] (last visited Dec. 10, 2018).

262. See Letter from Arthur Yuen, Deputy Chief Exec., H.K. Monetary Auth. on Fintech Supervisory Sandbox (Sept. 6, 2016), <http://www.hkma.gov.hk/media/eng/doc/key-information/guidelines-and-circular/2016/20160906e1.pdf>. Similarly, Singapore promises firms in its sandbox the prospect of relaxed regulatory requirements for innovations to be tested in a real-world setting. *Id.*

Hong Kong is also proposing a new sandbox for cryptocurrency exchanges. See *Hong Kong Securities Regulator to Propose 'Sandbox' for Crypto Exchanges*, REUTERS (Oct. 31, 2018, 10:22 PM), <https://www.reuters.com/article/us-hongkong-regulator-crypto/hong-kong-securities-regulator-to-propose-sandbox-for-crypto-exchanges-idUSKCN1N63DU> [<https://perma.cc/C4FR-5QWB>].

For completeness, it is worth noting that international sandbox initiatives are also being supported by state funding into fintech. Singapore has promised to spend S\$225 million over five years to develop innovation centers for finance and support technology projects. See Jamie Lee, *Singapore, London in*

must partner with an authorized banking firm to enter the sandbox.²⁶³ Once in, innovators have considerable regulatory room to develop their ideas. The sandbox is designed to help banking firms test new products even if those products do not yet meet with applicable regulatory standards. In all, Hong Kong appears to be relying on the advantages of incumbency to ensure that those participating in the sandbox are experienced, knowledgeable, and likely to operate safely relative to new and less familiar actors.²⁶⁴

In the United States, regulators have not expressly pursued the idea of an experimental sandbox but have signaled tentative support for the possibility of creating one in the future.²⁶⁵ U.S. regulators appear more focused on creating institutional support structures to guide fintech firms through the regulatory process, rather than providing specific spaces for experimentation. The CFTC, for example, has launched LabCFTC—a dedicated unit within the agency to support fintech development, liaise with innovators, and offer guidance on compliance.²⁶⁶ The SEC, in addition to issuing discrete guidance as part of its fintech regulation, has set up a working group on the application of blockchain to U.S. markets.²⁶⁷

Although most sandboxes and regulatory innovation hubs are only in their early years of operation, a mere cursory overview suggests that they, like other more limited forms of regulatory innovation, are designed to grapple with the trade-offs inherent in the trilemma. They aim to encourage financial innovation and, not infrequently, to enhance the competitiveness of local markets and financial systems. By creating a space for experimentation and dialogue with regulators—often with the help of simplified rules and compliance frameworks—new products can be developed and tested.

Race to Be Top Global Fintech Hub, BANKING & FIN. (Sept. 30, 2016, 5:50 AM), <https://www.businessinsider.com.sg/banking-finance/singapore-london-in-race-to-be-top-global-fintech-hub> [<https://perma.cc/B5VT-EFXC>]; see also *FinTech Regulatory Sandbox*, MONETARY AUTH. OF SING. (Jan. 9, 2017), <http://www.mas.gov.sg/Singapore-Financial-Centre/Smart-Financial-Centre/FinTech-Regulatory-Sandbox.aspx> [<https://perma.cc/26TL-NDG4>]; Herbert Smith Freehills, *Overview of Regulatory Sandbox Regimes in Australia, Hong Kong, Malaysia, Singapore, and the UK*, OXFORD BUS. L. BLOG (Dec. 18, 2016), <https://www.law.ox.ac.uk/business-law-blog/blog/2016/12/overview-regulatory-sandbox-regimes-australia-hong-kong-malaysia> [<https://perma.cc/63AL-39KV>].

263. See *Fintech Supervisory Sandbox (FSS)*, H.K. MONETARY AUTH. (Oct. 2, 2018) <https://www.hkma.gov.hk/eng/key-functions/international-financial-centre/fintech-supervisory-sandbox.shtml> [<https://perma.cc/9ZVR-7C5A>].

264. See Letter from Arthur Yuen, *supra* note 262.

265. See Neil Haggerty, *Treasury's Fintech Report to Encourage Sandboxes, Weigh in on Charters*, AM. BANKER (June 21, 2018, 4:45 PM), <https://www.americanbanker.com/news/treasurys-fintech-report-to-encourage-sandboxes-weigh-in-on-charters> [<https://perma.cc/LC6J-SE59>]; see also SEC. INDUS. & FIN. MKTS. ASS'N, FINTECH REGULATORY SANDBOX PROPOSAL (2018), <https://www.sifma.org/wp-content/uploads/2018/05/Fintech-Sandbox-Submission-May-14-2018.pdf> (showcasing support from the industry in support of sandboxes).

It should be noted that the state of Arizona is offering a sandbox for fintech and is the first state in the United States to do so. See Press Release, Ariz. Att'y Gen., *Arizona Becomes First State in U.S. to Offer Fintech Regulatory Sandbox* (Mar. 2018), <https://www.azag.gov/press-release/arizona-becomes-first-state-us-offer-fintech-regulatory-sandbox> [<https://perma.cc/TFT7-CFVJ>].

266. See *LabCTFC Overview*, *supra* note 35.

267. See *SEC Fintech Forum*, *supra* note 35 (providing page dedicated to the SEC's fintech initiatives).

These initiatives can offer meaningful gains. Sandboxes can help provide notice to regulators that their rules may no longer serve the objectives that regulators themselves envision. Similarly, these spaces may help refine and add nuance to new regulation or standards that are under development because experimental technologies reveal whether standards fall short or need supplementing in response to previously unseen circumstances. In Canada, for example, applicable securities regulation appeared to place constraints on the development of P2P lending platforms, particularly those targeting retail investors. Lending Loop, a P2P platform, faced suspension owing to its failure to comply with registration requirements by offering “securities” under Canadian securities rules. However, dialogue between regulators and Lending Loop (as well as other P2P platforms) led the OSC to offer the platform the chance to become an “exempt market dealer” to function.²⁶⁸

Sandboxes, then, can broaden the benefits of testing and refining compliance to reach beyond the fintech sector. By testing the limits of regulation at its margins, they may offer larger benefits as outdated rules are updated for the wider market after real world experience.

Sandboxes and innovation hubs can promote rules simplicity and financial innovation. They can offer a relaxed compliance regime for innovators. They can also rationalize existing regulation when experimentation shows certain rules to be unnecessary. Nevertheless, their operation can leave markets open to harmful risks, as the trilemma would suggest. The nature of trade-offs will reflect, in part, the regulatory parameters of the sandbox. Who can enter the sandbox? What kinds of rules are they subject to in the period of real-world experimentation? Perhaps most importantly, what constitutes a successful innovation? How regulators answer these questions is critical to determining which innovations are permitted into the market and how safely they operate once they have been approved and licensed for use. The conditions defining experimentation thus serve to provide a gatekeeping function in keeping bad innovations out and bringing beneficial innovations into use. If entry and assessment conditions are too permissive, their gatekeeping function will end up being ineffective.

As with any regulatory framework, financial authorities can make mistakes or errors in judgment in how they think about approving an innovation. Put simply, the sandbox may not be sufficiently informative about how an approved innovation is likely to work in the main market. Many national sandboxes—for example, Australia, Hong Kong, and the United Kingdom—require real-world experimentation to be conducted in accordance with specified, stylized conditions. For example, the ASIC’s license waiver requires that innovators have no

268. See *supra* note 260 and accompanying text; see also Alastair Sharp, *Lending Loop Reopens Peer-to-Peer Lending After Regulator OK*, REUTERS (Oct. 24, 2016, 12:06 PM), <https://ca.reuters.com/article/businessNews/idCAKCN12O1ZR> [<https://perma.cc/WWQ8-Z9SE>].

more than 200 (upper limit) retail clients or have an overall dollar exposure to customers higher than five million (Australian dollars).²⁶⁹ These conditions are, in many ways, eminently sensible: they are designed to prevent untested products from harming the larger market. However, they can also limit understanding of how effectively a fintech product might work. For example, a fintech advisory service (like robo advising) developed from a sandbox might be approved after experimentation on 200 clients. However, it is worth asking whether this service will be workable for a much larger and more varied cohort. Will the models deliver the same quality of advice to a larger and more diverse group of clients in the market? Will the models be sensitive to the aggregate impact of their advice? What if a large population group is advised to invest in similarly risky funds? Will the algorithms be capable of identifying and crunching data for a more complex set of scenarios when the firm intends to target different types of clients?²⁷⁰

At the same time, there may be a risk that regulators become overly enthusiastic about authorizing underdeveloped innovations and do so without sufficient heed to market integrity. Our discussion of global regulatory initiatives reveals the intense competition underway between countries to capture innovations and be first to bring them to market. The first movers are likely to be rewarded with an inflow of business as capital flows to jurisdictions that move it using state-of-the-art technology at the lowest transaction cost. Competition between regulators can be laudable in fostering dynamic markets. However, it might also provoke a chaotic race to the bottom as regulators jostle for space in promoting new innovations and championing national markets to the detriment of high standards in maintaining market integrity.

This fierce competition between national regulators has not gone unnoticed. For example, the Asia Securities Industry and Financial Markets Association (ASIFMA), an industry lobby group representing banks and investment fund managers, has pointed to the intense competition between national regulators as a stumbling block to progress, leading to fragmentation in the regulatory environment.²⁷¹ A key regulatory concern lies in the potential that this race to the bottom will cause poorly performing innovations in one jurisdiction to spread risks to another. The damaging impact of international competition on regulatory performance is all too vivid. U.S. efforts to deregulate the derivatives markets under the CFMA—designed to flaunt U.S. markets—contributed to the 2008 crisis,

269. See AUSTL. SEC. & INV. COMM'N, *supra* note 257, at 32; see also AUSTL. SEC. & INV. COMM'N, *supra* note 250.

270. See Baker & Dellaert, *supra* note 13, at 731–45.

271. See Michelle Price, *Hong Kong, Singapore Rivalry Hobbling Asia in \$100 Billion Fintech Race: Lobby Group*, REUTERS (June 9, 2017, 3:08 AM), <https://www.reuters.com/article/us-asia-fintech-idUSKBN1900LN> [<https://perma.cc/K9CL-CDDV>]; see also Jo Ann Barefoot, *RegLabs: Time for a Major Regulatory Experiment?*, BANKING EXCH. (July 13, 2017, 2:48 PM), <http://www.bankingexchange.com/blogs-3/unconventional-wisdom/item/6940-reglabs-time-for-a-major-regulatory-experiment> [<https://perma.cc/Q479-Z79J>] (advocating for the development of interagency “reglabs” or regulatory laboratories to enhance interagency cooperation and reduce the negotiation costs associated with working within a fragmented and complex regulatory structure).

with well-known catastrophic global consequences.²⁷² In short, as regulators develop a variety of strategies to oversee fintech, the trade-offs underlying the trilemma are made sharper and more complex by this innovation. This dynamic necessitates careful reflection on the part of policymakers to craft approaches that can facilitate innovation while also safeguarding market integrity and clarity in rulemaking.

IV. NAVIGATING THE REGULATORY FRONTIER

Our theory of the trilemma holds that regulators, when balancing three competing policy objectives—fostering innovation, maintaining market integrity, and offering rules simplicity—can, at best, fully achieve two out of three of these regulatory goals. We have further shown that current regulatory strategies should be interpreted as means of avoiding the most extreme trade-offs generated by the trilemma, offering a spectrum of responses that moderate opportunities and risks among the three policy goals.

In this Part, we suggest that regulators can deal with the unique risks and opportunities of fintech by adopting supplemental strategies designed to foster: (i) domestic agency cooperation; (ii) international standard setting; (iii) and better private self-governance of emerging technologies. By pairing these strategies with regulatory experimentation, the trilemma's risks of market instability and rules complexity can be hedged and more effectively mitigated. Although the trilemma cannot be avoided, its most damaging gaps can be more systematically assessed and controlled through the adoption of these supplementary strategies. Our proposal does not seek to stifle innovation or introduce unnecessary complexity to rulemaking. Rather, it aims to promote greater information generation and sharing both between regulators and between the private and public sectors as a way to capture a nuanced and complete picture of the risks created by innovation. Deeply informed regulators, we envision, should make more thoughtful and reasoned policy choices, reducing the risks posed by new financial creations while also finding ways to nurture the benefits these innovations can offer.

A. DOMESTIC AGENCY COOPERATION

Financial innovation—and fintech in particular—often arises in the interstices of any country's regulatory ecosystem; that is, discrete parts of transaction value chains are disintermediated by actors that pay little heed to traditional functional and regulatory boundaries.

This straddling necessitates strong domestic regulatory coordination to achieve any of the three regulatory goals. Such coordination would involve domestic regulators pooling information, sharing expertise, and identifying areas of common concern when innovations straddle sectoral boundaries. By doing so, regulators can acquire a fuller picture about the ways in which innovations (such as blockchain, virtual currencies, and alternative data) might impact financial markets

272. *See supra* notes 90–92.

broadly, not just within the purview of their specific agency. Regulators can better calibrate the potential impact of fintech on market integrity and devise rules in a coordinated manner that can facilitate greater clarity and simplicity in rulemaking.

From the standpoint of market integrity, coordination is necessary to prevent risks that can grow in the gaps of sectoral oversight. As we have seen, the decision to deregulate one sector—say, through special fintech bank charters—can impact the larger banking sector and payments system.²⁷³ Meanwhile, the interdisciplinary nature of many activities requires responses by multiple regulatory agencies to be effectuated properly. For example, for fintech firms that assist in settling securities trades or for those in digital currencies, permission would be necessary and desirable not only from the OCC, but also from the Federal Reserve, CFTC, and SEC.²⁷⁴ In the absence of a coordinated response, regulators risk adopting diverse approaches that stifle financial innovation, add complexity to rules, and make enforcement of the rules a source of systemic risk.

In short, coordination gives regulators a stronger handle on the full spectrum of new products being introduced into domestic markets and the risks these innovations generate.²⁷⁵ For regulators such as the SEC, CFTC, and Federal Reserve, each policing their respective jurisdictional turfs, coordination offers sharper insight into the full uses of a specific technology, as well as the problems it might generate across different sectors and agency jurisdictions. Innovations such as blockchain, specifically designed to create a distributed network for recording transactions (and perhaps settling transactions) can easily be applied to both securities exchanges (SEC), and transactions in derivatives (generally, the CFTC). In turn, failures in this technology, which underpin large-scale securities trading mechanisms, will impact financial stability (Federal Reserve and OCC). Similarly, payments technology, or peer-to-peer lending, designed to facilitate money flows between retail as well as corporate users, can also implicate consumer protection risks, engaging the jurisdiction of federal authorities such as the CFPB and state regulators.

Coordination can help regulators pool their insights and improve their individual analysis of an innovation to draw the lines (and stipulate acceptable trade-offs) that best represent their respective policy goals. By gaining insight into the

273. See John ReVeal & Rebecca H. Laird, *The OCC's New Fintech Bank Charter—What You Need to Know*, K&L GATES (Aug. 24, 2018), <http://www.klgates.com/the-occs-new-fintech-bank-charter—what-you-need-to-know-08-24-2018/> [<https://perma.cc/84M2-5FLU>].

274. See Gunjan Banerji, *Bitcoin Options Exchange Wins Approval From CFTC*, WALL ST. J. (July 24, 2017, 6:38 PM), <https://www.wsj.com/articles/bitcoin-options-exchange-wins-approval-from-cftc-1500935886> [<https://perma.cc/L6Q9-XWY5>] (noting differing agency postures and perspectives in regulating certain crypto-related products and technologies).

275. We do not examine the constitutional and administrative law issues that may be implicated by the greater coordination between domestic agencies. See generally Lisa Schultz Bressman & Robert B. Thompson, *The Future of Agency Independence*, 63 VAND. L. REV. 599 (2010) (discussing constitutional and administrative implications from the independence-accountability hybrid agency approach).

collective risks they face, regulators can decide how to approach rulemaking with respect to a new innovation. Can new innovations be regulated effectively under existing rules and standards? Or do old rules require adaptations to suit emerging technology? As evidenced by minimally interventionist no-action letters, regulators may determine that minor modifications to existing regulation may suffice to absorb the risks to new regulation.²⁷⁶ On the other hand, as exemplified by the OCC's fintech charter and the SEC's retail equity crowdfunding regime, a novel deployment of regulatory tools may be viewed as necessary to tackle new risks and opportunities arising in financial markets.²⁷⁷

In all cases, coordination allows for a more tailored treatment that is specifically calibrated to address the risk that an innovation carries across financial markets, rather than in just one sector. This observation is not to suggest that all regulators should apply the same rules or exercise oversight with uniform intensity. Inevitably, different agencies will vary in their intensity and focus, depending on the degree of risk posed by a particular innovation. The SEC might be expected to pay special attention to robo advisors and their AI, given their significance for securities markets and the scope of the SEC's authority over investment advisors. However, in all cases, coordination between agencies permits the Federal Reserve, CFTC, and SEC to pool insights, knowledge, and regulatory experience to understand how robo advisors affect the financial markets broadly. It may be, for example, that the increasing market share of robo advisors means that their failure raises concerns about prudential, systemic stability—an issue of interest for the Federal Reserve.

Finally, interagency coordination can benefit fintech firms. In seeking to mitigate the effects of the trilemma, a more efficiently administered compliance regime may give regulators room to pass a tougher set of rules for market safety while maintaining a workable on-ramp to innovation. As we have described, fintech is characterized by nonincumbent firms that are increasingly taking the lead in innovation. These newer firms may be new to compliance in financial regulation, placing them at a disadvantage competitively to more seasoned actors. Moreover, they may not possess the resources, including money to pay for legal fees or registration costs, to even attempt entry into financial markets.²⁷⁸ To the extent that regulators might wish to encourage innovation, the trilemma explains that they would need to relax and simplify the rules to do so, at a risk to market integrity.

Coordination can help reduce the compliance costs facing newer entrants, opening the door for regulators to potentially impose stricter regulation. Where regulators see an innovation that might be implemented across markets—including equity, derivatives, and banking—they may consider whether joint permission and oversight is appropriate. This approach ease the costs on new firms that wish to

276. *See supra* Section III.A.

277. *See supra* Section III.C.

278. *See id.*

offer their services to multiple markets, allowing the firms to traverse a host of regulatory and jurisdictional regimes. It may also allow regulators to jointly craft conditions that holistically reflect a firm's risks, streamlining compliance costs. As shown by the OCC's proposal for its fintech charter, regulators appear willing to move on a case-by-case basis and prepared to adopt bespoke conditions based on the firm seeking to gain authorization.²⁷⁹ The OCC's approach may be broadened so that a firm can apply to multiple regulators at once for a joint determination. Under such a regime, fintech firms may be incentivized to enter markets. The stipulated conditions under which fintech firms pursue their activities may also be better tailored to their risk profile.

Such a streamlined approach is far from perfect, particularly in light of how U.S. market regulation is currently structured. It would require agencies to overcome decades of fierce jurisdictional battles, and regulators may not achieve consensus on risks to successfully create a joint mandate for fintech firms. As noted above, the OCC and the Federal Reserve, for example, may emphasize risks to financial stability, whereas the SEC may highlight risks impacting market efficiency and investor protection, and the CFPB may focus on how a firm's activities affect consumer interests. Additionally, how might existing, incumbent firms react if fintech actors appear to enjoy a potentially simplified, more streamlined regulatory regime?

These problems may not be insurmountable. Notably, following the 2008 financial crisis, agencies have sought to institutionalize formal mechanisms for coordination on matters of financial regulation and systemic risk through the Financial Stability Oversight Council (FSOC).²⁸⁰ Moreover, incumbent financial firms may be willing to accept a consolidated regime with potentially lower compliance costs for fintech firms when permission clearly and narrowly stipulates the conditions under which these firms can operate. Fully authorized incumbents may tolerate a distinct regulatory regime for fintech firms where incumbents can continue to operate to the maximum extent permissible under existing regimes.

As with a failure by regulators to coordinate with their peers internationally, a failure by agencies to work in lockstep may catalyze a race to the bottom through which agencies compete to capture the next big innovation. Competition between regulators and a lack of coordination and information sharing may incentivize fintech firms to look for the lowest cost compliance regime to enter the market. Put simply, a firm may look for those regulators that offer entry on lax terms, with

279. *See id.*

280. *See Financial Stability Oversight Council, supra* note 29. For insightful discussion of the goals and mechanisms underlying FSOC's authority to designate firms as systemically risky and needing more intensive consolidated supervision, see Schwarcz & Zaring, *supra* note 31. For perspectives on the costs of the FSOC's designation power and the significance of nuanced, consolidated supervision to develop informational resources for regulators, see Hilary J. Allen, *Putting the "Financial Stability" in Financial Stability Oversight Council*, 76 OHIO ST. L.J. 1087, 1091–1110 (2015) (discussing the structure and function of the FSOC and the significance of expertise and political neutrality); Christina Parajon Skinner, *Regulating Nonbanks: A Plan for SIFI Lite*, 105 GEO. L.J. 1379 (2017).

greatest rules simplicity, thereby increasing peril to market integrity more broadly.

B. INTERNATIONAL STANDARD-SETTING AND COORDINATION

Similarly, international coordination is a necessary and natural complement to regulatory experimentation and adaption.²⁸¹ Fintech services are digitally based, easily scalable, and operationalized across borders. To minimize risks to market integrity—especially consumer and systemic risks that can be exported abroad—regulators will have to work closely with one another.²⁸² Where they do not, excessively heterogeneous processes and approaches could not only stifle the growth and development of socially beneficial innovation, but also enable the obfuscation of risk and the undermining of vital information sharing and data assessment.

Differing national approaches have the benefit of adding layers of extra comfort and security for regulators charged with protecting their domestic markets. However, multiple compliance regimes do not always add to consumer protection or financial stability, and in some instances can detract from it, all while adding to regulatory compliance costs. For example, in the case of regulatory reporting for the OTC derivatives implicated in the 2008 crisis, both the United States and the European Union have come up with diverging data fields and reporting standards for swaps repositories as part of regulatory reforms to track the build-up of risk in derivatives markets.²⁸³ But because the standards are, in fact, not entirely standardized, not only is reporting more complicated, but information gathered is not always (or even normally) easily able to be aggregated and analyzed by supervisors.²⁸⁴ Thus, not only is it harder for firms to develop new and better technological methods and approaches to report data, but market integrity is ultimately undermined.²⁸⁵

It is worth adding that insufficient international coordination—combined with fierce competition between regulators to attract innovative businesses—can also trigger a regulatory race to the bottom. Even without this situation, the idiosyncratic risk preferences of one set of national regulators may be unacceptable to

281. See Lev Bromberg et al., *Cross-Border Cooperation in Financial Regulation: Crossing the Fintech Bridge*, 13 CAP. MKTS. L.J. 59 (2018) (noting the potential for cross-border cooperation on fintech based on such past cooperation through the International Organization for Securities Commissions).

282. See CHRIS BRUMMER, *MINILATERALISM: HOW TRADE ALLIANCES, SOFT LAW, AND FINANCIAL ENGINEERING ARE REDEFINING ECONOMIC STATECRAFT* (2014) (discussing the move towards local regional alliance building in smaller regional communities); CHRIS BRUMMER, *SOFT LAW AND THE GLOBAL FINANCIAL SYSTEM: RULE MAKING IN THE 21ST CENTURY* (2012) [hereinafter BRUMMER, *SOFT LAW*] (examining the system of soft-law rulemaking and standard-setting in post-crisis global regulation).

283. See CHRISTOPHER MURPHY ET AL., *ATL. COUNCIL, THE DANGER OF DIVERGENCE: TRANSATLANTIC FINANCIAL REFORM & THE G20 AGENDA* 29–39 (2013), http://www.atlanticcouncil.org/images/publications/Danger_of_Divergence_Transatlantic_Financial_Reform_1-22.pdf.

284. See *id.* at 40–49.

285. See *id.*

others, such that innovations in one jurisdiction may not be acceptable more widely. Divergence in the intensity of oversight between regulators can be seen in how regulators encourage new entrants to their markets and the kinds of criteria they set for those wishing to test out new technologies. Sandboxes, for example, vary substantively in the eligibility criteria they set for entry and participation. Whereas Hong Kong limits its sandboxes to regulated banks or those that work with banks, others, such as those of the United Kingdom and Australia, are open to nontraditional, smaller firms, including startups.²⁸⁶ Jurisdictions also differ in how much risk they permit those in their sandboxes to take, with variations in how much money and the number of customers that may be placed at risk. Some sandboxes, as in Hong Kong, do not specify a fixed time limit for testing but others, such as those of Australia, do.²⁸⁷

Cross-border coordination could, if effective, provide an antidote, at least in part, to these challenges. However, achieving such coordination will not be easy. Regulators have divergent mandates and objectives and oversee vastly different economies. Some regulators may prioritize financial inclusiveness and innovation in capital access, whereas regulators of more mature markets may emphasize innovations that shore up the progress already achieved. Jurisdictions invariably vary in the intensity of oversight they exercise in authorizing new innovations and the conditions under which new innovations are accepted into the main body of the financial system. Regulators are also likely to offer different levels of litigation and enforcement immunity, leading to varying answers to basic regulatory questions, including: what kinds of errors will firms be allowed to make in the trial process and what quality of fail-safes must firms use to remedy deficiencies and participate fully in markets? Or, with innovation being led by smaller firms with diminishing reliance on traditional intermediaries, what protections will regulators impose on entrants that may not be sufficiently mature or profitable enough to hold large capital buffers or internalize large compliance costs?

Regulators can also diverge in what policy goals they expect fintech to achieve for financial markets. For instance, Malaysia and Singapore envision that innovations nurtured in their national sandboxes will, first and foremost, benefit Malaysian and Singaporean domestic markets.²⁸⁸ The criteria by which innovations are analyzed, accepted for use, and implemented appear to be primarily determined by reference to the characteristics of the regulator's domestic markets. Given these idiosyncratic preferences, one regulator's particular assessment metrics may not fully align with its peers in another jurisdiction. Yet innovations fostered in one may impact markets in others, including through the payments or banking systems. One country's regulators may also give permission for products authorized in another country to be used in its home market. This occurrence may

286. *See supra* Section III.D.

287. *See* HERBERT SMITH FREEHILLS, HONG KONG LAUNCHES REGULATORY SANDBOX IN WAKE OF DEVELOPMENTS IN AUSTRALIA, MALAYSIA, SINGAPORE, AND THE UK (2016), <http://sites.herbertsmithfreehills.vutvurevx.com/103/12430/landing-pages/2016.09.30-apac-fintech-briefing.pdf>.

288. *See id.*

happen if both countries believe that the other's regulatory supervisory systems are robust and reliable. However, such assumptions may prove illusory, resulting in risks moving from one country to another.

Still, international coordination and standard-setting offers a mechanism by which regulators can narrow differences and reach base-line consensus on how to understand and assess new innovations and articulate the terms of this agreement. Greater recognition of shared risk can help motivate regulators to overcome both policy and political differences, and the desire to compete for capital may provide regulators with incentives to institute the lowest cost compliance regime within their home markets.

Forums within which policymakers can discuss emerging technologies can help cure some of the gaps in the trilemma as well as the tendency to legislate at its poles, helping regulators to more fully understand new technology and fill information gaps. The value of such dialogue is especially high in fintech given that it presents new and unfamiliar risks—for example, reliance on sophisticated algorithms, nonincumbent firms, and big data. With regulators able to jointly convene to discuss fintech, they can better analyze how complex algorithms are likely to work, develop a richer history on the risks and operations of new firms, and understand the limits of the data available to them. This process can help regulators formulate joint standards about activities that can create a more informed and more level, playing field for fintech activity.

Finally, international coordination and standard-setting is familiar territory for financial market regulators following the 2008 financial crisis. The post-crisis regulatory architecture, organized under the aegis of the G-20 group of nations, has successfully promulgated a series of soft, nonbinding directives to codify a basic set of shared standards across areas.²⁸⁹ From banking and derivatives to securitization, a swath of the post-crisis financial regulatory architecture has been put in place through international consensus-building and standard-setting.²⁹⁰

It follows that this existing framework for market regulation may be harnessed to develop a more coordinated regulatory response to fintech. For example, the International Organization for Securities Commissions, the standard-setting forum for securities market regulators, has signaled concerns about emerging fintech and the risks of diverging national regulatory regimes.²⁹¹ Similarly, the Financial Stability Board convenes regulatory fintech working groups, though as of this writing, they have, for the most part, focused on financial stability and

289. See generally BRUMMER, *SOFT LAW*, *supra* note 282, at 62–114. As Brummer writes, owing to a variety of levers, these soft standards are hard in practice, creating pressure on regulators to ensure their adoption into national law. *Id.* at 111–12.

290. For discussion on the history of soft law in international financial regulation and the institutional mechanisms underpinning its development, see *id.*

291. See INT'L ORG. OF SEC. COMM'NS, *IOSCO RESEARCH REPORT ON FINANCIAL TECHNOLOGIES (FINTECH)* 31–35 (2017), <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD554.pdf>.

banking (and central banking).²⁹² The need for coordination between work streams remains essential, as fintech innovations like blockchain or artificial intelligence straddle functional regulatory classifications and impact financial as well as securities markets. It seems timely to more systematically address fintech across international standard-setting bodies and member countries.²⁹³

C. PRIVATE MONITORING AND INDUSTRY CODES OF CONDUCT

Finally, regulatory innovation and experimentation should be bolstered by complementary support structures in the private sector. New fintech firms and incumbents alike can help reduce risks to markets by: (i) monitoring each other; (ii) setting rules of the road for their industries to privately codify acceptable standards; and (iii) privately enforcing these norms through industry sanction, reputational harm, and exclusion from the market in case of egregious behavior.

Encouraging private self-regulation as a supplement to robust public oversight can mitigate difficulties endemic to the trilemma. Private self-regulation can be especially helpful in filling gaps and informing the quality of public regulatory oversight. It brings together industry players to regulate and police one another. Beyond offering an added layer of oversight, private self-regulation can help make market participants more directly responsible for maintaining high standards within their industry. Common forms of such oversight allow firms to design a framework of rules and norms to govern their behavior and to control the risks that such conduct might create.²⁹⁴ To ensure compliance with these standards, self-regulation can include disciplinary and adjudicatory mechanisms to sanction those that do not play by the rules. Finally, self-regulatory industry organizations can pool informational and analytical resources as part of their regulatory and enforcement processes.

This kind of oversight has many advantages, especially for fintech. First, private firms can provide regulators with a source of knowledge on emerging technologies. Regulators can arguably benefit from interaction with those that are most familiar with technology such as machine learning algorithms, distributed ledger operating systems, or alternative data.²⁹⁵ Further, as fintech focuses on disintermediating traditional financial functions, regulators can benefit from gaining intelligence on the technology that promises to replace the long-established

292. See, e.g., U.S. FIN. STABILITY BD., FINANCIAL STABILITY IMPLICATIONS FROM FINTECH: SUPERVISORY AND REGULATORY ISSUES THAT MERIT AUTHORITIES' ATTENTION (2017), <http://www.fsb.org/wp-content/uploads/R270617.pdf>.

293. See Bromberg et al., *supra* note 281.

294. See Gabriel V. Rauterberg & Andrew Verstein, *Assessing Transnational Private Regulation of the OTC Derivatives Market: ISDA, the BBA, and the Future of Financial Reform*, 54 VA. J. INT'L L. 9, 19–29 (2013); Frank Partnoy, *ISDA, NASD, CFMA, and SDNY: The Four Horsemen of Derivatives Regulation?* 2 (Univ. of San Diego Sch. of Law, Pub. Law & Legal Theory, Working Paper No. 39, 2002), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=293085 [<https://perma.cc/X8UY-MH9X>].

295. For example, some banks have called for greater private self-regulation in development of common standard for blockchain technologies. See Ian Allison, *Barclays, Goldman Champion ISDA Standard for Blockchain Derivatives*, COINDESK (Apr. 27, 2018, 8:01 UTC), <https://www.coindesk.com/barclays-goldman-champion-isda-standard-blockchain-derivatives/> [<https://perma.cc/HT9D-UY9K>].

market structure. By formalizing channels for regulators to communicate with practitioners, regulators can lessen the challenges of interpreting data and can better understand risks and how they might fit within existing law. Regulators may benefit by facilitating interactions through formal industry organizations, rather than one or two big firms. By communicating with an industry body, such as a trade association, regulators might not only gain a diverse breadth of knowledge, but also avoid becoming captured by large firms.

In fintech, such collaborative initiatives are already underway and appear to have been productive. Most notably, Canadian authorities worked with R3, an industry blockchain consortium comprising eighty financial firms, as part of its study into whether to put their interbank payment system on a blockchain settlement system. After discussion with the consortium, Canada decided not to adopt this technology, determining that the technology was not ready for its domestic use.²⁹⁶

There are also good reasons for firms to develop strong industry rules and norms. By crafting robust oversight and disciplinary mechanisms, firms can transact with others on a surer footing, better assured as to a basic standard of quality with respect to financial products and services and the participants that offer them. In financial markets, where risks can spread quickly through interconnected networks and supply chains, such comfort can bring important benefits. Firms do not have to repeatedly internalize high investigation and due diligence costs with respect to each counterparty. They can also share information, increasing collective reserves of insight to understand these risks and to prevent them from arising. Perhaps most importantly, self-regulation can permit industry players to have a degree of control in crafting standards and in enforcing them. To the extent that private firms possess expertise and frontline knowledge about the industry, such control may be exercised in an informed and precise manner. If self-regulation results in a reliable body of standards and norms, firms may be able to avoid being subject to heavy top-down regulation.

Importantly, regulation may benefit from industry self-monitoring and informal enforcement through reputational sanction or exclusion. This benefit may be especially helpful in contexts in which policymakers decide to pursue innovation and rules simplicity, at a likely cost to market integrity. When regulation is expressly favorable to industry in a bid to foster innovation, private self-regulation may promote adherence to core standards that those within the industry consider appropriate to the risks. This result can create a second source of oversight, particularly if public regulation is less intensive. For example, private securities exchanges have long regulated their traders as well as issuers for compliance with laws and industry norms. In addition to making rules, exchanges

296. See Neil Ainger, *Canada Backs Off Blockchain Interbank Payment System*, CNBC (May 26, 2017, 6:19 AM), <https://www.cnbc.com/2017/05/26/canada-backs-off-blockchain-interbank-payment-system.html> [<https://perma.cc/G6M3-TQ5X>]; Anna Irrera, *JPMorgan Chase & Co Leaves Blockchain Consortium R3*, REUTERS (Apr. 27, 2017, 2:29 PM), <https://www.reuters.com/article/us-jpmorgan-r-idUSKBN17T2T4> [<https://perma.cc/TP82-7L67>].

are also tasked with enforcing securities laws against those that use their services.²⁹⁷

Of course, private self-regulation can also fall short. For example, exchanges have been critiqued for sometimes taking an overly lax approach to supervision and enforcement.²⁹⁸ And critically, in the years prior to the 2008 crisis, industry self-regulation in the over-the-counter swaps market (like CDS) fell well below what was needed to keep markets safe, and likely contributed to the intensity of the failure.²⁹⁹

We do not suggest that private self-regulation replace robust public oversight of fintech—to the contrary. We only note that industry can offer a helpful supervisory and supplemental backstop, facilitating a more informed understanding of emerging technology as well as a mechanism for private peer monitoring between specialist actors. Perhaps most importantly, giving private industry actors a role in the regulatory framework can yield benefits—for example, through consultations with policymakers or in the exercise of private peer discipline. Such a role can force industry players to more deeply examine the technologies they are bringing to the market, the risks these create, and how private actors may safeguard their own firms against a crisis. Rather than simply focus on the profits and opportunities offered by fintech, the process of developing industry standards and codes of conduct may provide a way for fintech to mature. As industry gains a fuller picture of the net costs of activities, those that enter the markets may be better equipped to understand and absorb these costs.

CONCLUSION

Innovation is a constant feature of financial markets, but not all financial innovation is the same. In this latest iteration of market creativity, policymakers are confronting a digital disintermediation of traditional financial services providers that leverages more and qualitatively different forms of data as well as automation and machine learning. Collectively, these developments exacerbate long-standing trade-offs regulators face when tasked with exercising oversight over changing markets. Using the analytical lens of a trilemma, we take a first step to more clearly articulate these trade-offs and their implications for regulation. Specifically, we argue that when seeking to provide clear rules, maintain market integrity, and encourage financial innovation, regulators have long been able to achieve, at best, only two out of these three goals. Moreover, the new technologies transforming markets complicate discerning where along the policy frontier any decision is situated given their own novel (and untested) nature.

297. See Yesha Yadav, *Oversight Failure in Securities Markets*, CORNELL L. REV. (forthcoming 2019), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2754786 [<https://perma.cc/K5VL-49BT>].

298. See *id.*

299. See *supra* Section I.C.3.

We have observed that regulators are modifying well-worn approaches to oversight as well as innovating new ones to adapt to digital markets. Yet even these creative administrative responses are beset by their own limitations including insufficient international and even domestic coordination. With this in mind, this Article has set out pathways to more fully equip policymakers with tools to adapt their markets to fintech and its risks and opportunities.

